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VIEWS, NEWS AND INTERVIEWS.

Mr. Mordey, the English electrical engineer and inventor, spells the plural of dynamo as "dynamoes." One of our London contemporaries congratulates him on this achievement, as the spelling matches that of other words ending in "o." Mr. Mordey also invented the word "alternator."

One of the most important electrical engineering schemes on record, by which power is to be conducted from Santa Ana to Los Angeles, Cal., a distance of 80 miles, under a pressure of 33,000 volts, is now in process of consummation. Two of the gentlemen who have undertaken it are H. H. Sinclair and O. H. Ensign, vice-president and electrical and mechanical engineer, respectively, of the Southern California Power Company. It is proposed to deliver electrical energy equivalent to 4,000 horse-power in the car-house at Los Angeles. The power station is in Santa Ana canyon, 12 miles from Redlands and 80 miles from the point of development. The current will be generated at 1,000 volts and transformed up to 33,000. The power is derived from the waters of the Santa Ana River, which is to be directed from the stream by a canal, flume and tunnel work along the side of the canyon to a point where it suddenly drops through 2,200 feet of pipe, a distance of 750 feet, to the water wheels.

Paris and Marseilles are now connected by telegraph lines entirely under ground. They are placed in iron pipes and buried four feet beneath the surface, with manholes 3,000 feet apart. It cost $7,000,000 to bury the wires.

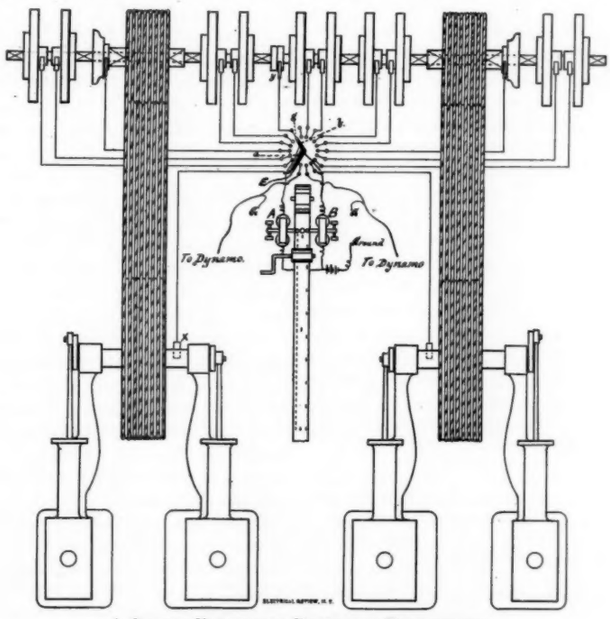
So the first big plum in the electric traction pie has been successfully extracted by our American friends. The contract for the equipment of the Central London Railway has been given to the General Electric Company, of the United States, whose agents in England are the British Thomson-Houston. It is a little matter of £275,000—a mere fleabite, of course, compared with the great total which will be spent before long on similar work in the United Kingdom.—*London Lightning.*

Mr. W. H. Preece, the well known English electrician, who is said to be slated for knighthood honors at the Queen's Jubilee, is credited with telling the following experience: "When the telephone was getting into work the Queen was anxious to test its powers, and, accordingly, arrangements were made to put Osborne, Portsmouth and London in telephonic communication with one another. With this in view I went to Southampton, and it was arranged that a band should play in London at 9 o'clock, so that Her Majesty might hear the music. Some slight mishap occurred to the Osborne section of the wire, and the Queen's coming was delayed. The musicians, after playing some time, were dismissed. Shortly after, to my consternation, I received a wire from Osborne, stating that the Queen had arrived and was ready to hear the music. What was to be done? The band had departed and there was no way of getting another! On a hasty impulse I decided to see what I could do and hummed 'God Save the Queen' through the telephone. Then I inquired if Her Majesty had recognized the tune. 'Yes,' was the reply; 'it was the national anthem, but very badly played.'"

President Berri, of the Brooklyn Bridge trustees, refuses to sign a contract at present which would enable the Brooklyn Elevated Railway Company to build connections and operate cars across the Bridge.

A system for lighting, heating and ventilating railway cars by electricity has been given a practical test by the Pullman company, and it has been highly commended.

The Rhine is to be tapped at August to furnish power for an electric generating plant for the town of Basle. The channel which is to carry the water to the turbine house will be about three-fourths of a mile in length. At first 7,700 cubic feet of water per second will be available, representing about 9,000 horse-power.



A Simple Electrical Recording Tachometer.

A SIMPLE ELECTRICAL RECORDING TACHOMETER.

BY L. E. JONES.

It often happens that in the testing or operation of a lighting or power plant it becomes necessary to quickly ascertain the exact number of revolutions of a number of shafts, clutches or other revolving parts, to determine positively any slipping of belts, ropes or similar devices that may occur. While the speed of any one or more shafts can easily be determined by means of any of the various forms of speed indicators or tachometers now in use, it would require a number of instruments and as many operators to show the revolutions of several parts simultaneously, and even then no record would be kept of the results. The electrical tachometer, herein described, was constructed and used by the writer some time ago at the electric light plant of the west Chicago parks, and proved itself extremely useful in quickly and accurately indicating the number of revolutions, as well as any slipping occurring in the many clutches, the jack shaft, the rope drive and pulleys. There are nine dynamos driven by clutch pulleys with rope drive from a jack shaft located directly under the dynamo floor.

The tachometer is a very simple arrangement, and can be readily constructed by any one with materials generally found around a plant of this kind, excepting a pair of ordinary telegraph sounders, A and B. To the end of the armature lever of each sounder is fastened a piece of pencil lead, so that when current passes through magnets the pencils make dots on a paper tape, which is being moved along by a pair of wooden rollers. These rollers can be turned by hand at any convenient speed, which, of course, should be fairly uniform. A few cells of dry battery, some copper-headed tacks, a few strips of brush copper, and some insulated, or even bare, copper or iron wire complete the list of necessary materials.

A strip of strong paper is pasted around a shaft or on the hub of a

pulley which it is desired to time. The paper does not reach quite all the way around, but a gap is left so that when the small brush which consists of a single leaf of brush copper comes to the bare place, it makes contact with the iron and completes the circuit through the sounder, or recorder, the other pole of the battery being permanently grounded.

Each pulley or shaft must have a circuit-closer thus constructed with a copper brush, from which a wire runs to a small circular switch on the recording instrument. This switch can be constructed by driving some copper-headed tacks in a circle so that a small switch lever at the center may be readily shifted to any point in the circle. The wires from the clutches, etc., are fastened to these tack-heads, which can be lettered or numbered to designate which clutch or shaft each connects with.

There should be a switch for each of the recording sounders, so that any pulley may be attached to either instrument, thereby making any desired combination possible.

The switchboard has two concentric contact circles, and the two lever arms A and B are insulated from each other, one being connected to one recording instrument and one to the other.

When a shaft or pulley revolves, the small copper brush touches the metal at the gap in the commutator and completes the circuit to the ground from the wire leading through the instrument from the battery, and returns to the battery by the permanently grounded wire.

The dynamo connections should be made by placing a small piece of brush copper on a block of wood fastened directly on the end of the dynamo shaft. There should be two small brushes held against the commutator in such a position that the strip of copper closes the circuit between the two brushes at every revolution of the dynamo. Care should be taken to keep the small brushes and the commutator insulated from the dynamo shaft, lest a fault in the dynamo insulation might divert the current through the recording instrument to ground.

The tape only costs a few cents per roll, and can be obtained from any one handling telegraph supplies. The appearance of the record on the tape can be plainly seen in the cut. It represents the speed of the engine on one side and that of the jack shaft on the other, the shaft making four revolutions to one of the engine.

I have recorded perfectly 650 revolutions per minute, and much higher can easily be reached.

For convenience I will trace out the connections for this one record, which will serve as a guide for the others.

First, as the engine shaft revolves and the small brush X leaves the end of the paper strip and comes in contact with the bare shaft, the current starts from the battery and passes through recorder B to the lever arm *a* and to point E, thence to engine through wire leading thereto, and through engine shaft to ground and return to battery, so recording the revolutions of the engine.

Second, when the brush Y, which rests upon the paper commutator on the jack shaft, reaches the uncovered space it makes contact with the shaft and the current starts from the battery, passes through recorder A to lever *b* and to point S, thence to shaft through connecting wire and to ground and return by ground wire, thus recording the revolutions of the jack shaft.

Between the two pencils attached to the recorders is a third pencil fastened so that by tapping it with the fingers it makes a dot on the paper between the other two rows of dots. This is the timing pencil, and may be tapped as often as desirable, say at intervals of from ten seconds to one minute. The record represented, if continued for one minute, shows:

1. The total number of revolutions per minute of engine.

2. Whether the engine ran fast in one part of the minute and slow in remainder, or raced.

3. The total revolutions of the jack shaft.

4. The slip in main drive, or the slip in clutch, if any, the relation between the engine drive wheel and the main clutch pulley being previously known.

5. Whether the slip occurred at one time or was distributed throughout the whole minute.

As stated previously, the tape does not have to run through with absolute regularity, since the record is perfect at varying speeds of the tape and is only comparative. If desirable, the tape and entire mechanism for running it may be dispensed with and the indications read off with accuracy by sound direct from the telegraph sounder. For example, if you desire to see if one of the clutches is slipping very slightly, you may connect the clutch to one sounder and the jack shaft to the other. If the two instruments keep perfectly in step for the entire time, then there is no slip. The instruments do not have to move in unison, but they must keep step in the same relation to each other. If there is one-quarter of a revolution slip in the entire minute, it is readily detected.

If a test is desired between two parts with different speeds, they should be tried without any load and notice taken of how many times the sounders synchronize and get out of step again per minute. Then, when the load is on, if there is any slip, it will change the time required for the sounders to synchronize.

LITERARY.

McClure's Magazine for July will contain an article on the late Professor Drummond, written by his intimate friend, the Rev. D. M. Ross. The source of Drummond's rarely equaled influence over men—assemblages as well as individuals—was his own charm of character; and Mr. Ross's paper will deal especially with his personal traits. With it will be printed several portraits, among others the last, and what his friends regard as the best, taken of Professor Drummond.

The Tennessee Centennial.

To the Editor of Electrical Review:

Upon my return to the centennial city I find the exposition in full swing and vastly improved over its condition and appearance when I wrote you a month ago. The improvement is general and very noticeable on all sides. The excellence of this exposition has seldom been surpassed in the history of this country, and the people of Tennessee and the exposition managers deserve the praise of the nation for the splendid creation which they have, by dint of true American enterprise and energy, succeeded in bringing to such a splendid realization, in the face of the fact that it was accomplished at a time when the great majority of the people of the United States were engaged in an earnest search for that elusive ingredient called "prosperity," which has always, heretofore, been considered very necessary in carrying to a successful culmination vast undertakings and enterprises, especially those in the nature of expositions. Surely the Tennessee people and the Exposition Company deserve all the praise that can be bestowed for their pluck, perseverance and patriotism.

It is to be regretted that the electrical industries are so meagerly represented; this, however, is, in a measure, compensated for by the magnificent illumination of the grounds and buildings by the Exposition Company's plant, which has a capacity of 4,000 horse-power filled up. The buildings certainly show the most beautiful display of light and color imaginable. To those who saw the illumination of the buildings at the World's Fair it will probably seem presumptuous to say that the Tennessee Centennial illumination surpasses it, but it is an incontrovertible fact. To the skill of Mr. J. W. Pentecost, superintendent of electrical department, is this very successful installation due, all of which is underground construction. The entire plant has been recently inspected by Mr. W. S. Boyd, of Chicago, in the interest of the insurance companies, and pronounced satisfactory.

I find no new electrical exhibits since my last letter, with the exception of that of J. W. Braid, of Nashville, who shows a very handsome line of small motors, fans and house goods.

The American Electric Telephone Company, of Chicago, has greatly improved the appearance of its booth by the addition of a number of new instruments. They now have a full line of their high-grade goods in evidence, and it is a very handsome display, indeed.

I am told the attendance has not been up to the expected mark, and not what the show deserves. Let us hope it will improve.

A true southern welcome was extended to President McKinley upon the occasion of his visit to the centennial. His address was highly commended by all.

It is unfortunate that more of the electrical associations did not arrange for their meetings and conventions to occur in Nashville. I believe there are some 400 conventions of one kind and another booked for Nashville during the exposition, and of these only two are electrical. I refer to the United States Military Telegraphers and the "Old Timers," and, as a member of the latter organization, I want to say to my comrades that they can not afford to miss this meeting.

To all the boys I want to say, Get in line to make the trip. You will never regret it. In addition to the beautiful grounds and buildings of the centennial exposition the country hereabouts is romantically picturesque, and will be in the zenith of its delightfulness at the date of these meetings in September. They can feel sure of encountering the very best brands of proverbial southern hospitality in Robertson County, and if any of the boys should lose their passes, or get lost in the shuffle, a fleet of centennial airships will be provided for their homeward journey.

M. O. Reanon.

Nashville, Tenn., June 15.

Proposed Electric Railways in Ghent, Belgium.

Under date of April 16, 1897, United States Consul Morris wrote from Ghent to the Department of State, as follows:

The final project for the electric street railways to be constructed in this city is almost ready for publication. For some time past the plans and specifications, and the details of the conditions of the franchise to be proposed on the part of the city have been under consideration by the committee of the council. It is now expected that all particulars will be published for the information of the public and the contractors about the end of this month. As several possible American bidders have made inquiries of this consulate, relative to this project, it may be well to mention the details, so far as are now known. All, however, are only preliminary and may be modified before final approval by the council. The franchise includes all the lines proposed for the entire city, and will be sold to the highest bidder at a fixed annual rental, to be paid to the city for a certain term of years, at the expiration of which the city reserves the privilege of purchasing the entire system. The lines to be operated are numerous and will be planned by the city. The motive power is to be electricity—in the central portion of the city, the accumulator, and in the outlying districts, the trolley system. There will be two separate classes for passengers; the fare in the first-class is fixed at three cents, and in the second-class at two cents. The working hours of employés are to be 13½ to 14½ hours. The wages of drivers, conductors and workmen are fixed at 72⅛, 69½, and 58 cents per day, respectively. Other details will be fully set forth in the specifications to be published, as previously stated, about May 1. Bids will then be received during a period of two months and the final award of the franchise will be made on or about July 1. These dates are not yet definitely settled, and their mention here being only approximate, does not involve any responsibility. All persons interested should at once address requests for plans and specifications to the burgomaster of Ghent. Copies will be forwarded by me to the Department of State, and, as far as possible, to persons requesting them. At the same time, it should be noted that as the time for bidding is comparatively short, any firm anticipating the possibility of obtaining the award would do better to have a specially authorized agent on the spot.

The Effect of the Roentgen Rays on the Tubercle Bacillus and on Diphtheria Toxin.

The question whether the Roentgen rays exert any influence on bacterial life is of considerable interest, and conclusive evidence on at least a part of the subject seems to have been arrived at by Dr. J. Brunton Blaikie, president of the Edinburgh Royal Medical Society. His experiments, published in the current number of the *Scottish Medical and Surgical Journal*, were as follows: Portions of glycerine agar having been placed in small boxes of aluminum, which is more transparent to the rays than glass is, they were sterilized and inoculated with streak cultures of the tubercle bacillus. At the same time four healthy guinea pigs were inoculated with twice the minimum lethal dose of diphtheria toxin, and the remainder of the diphtheria toxin was placed in another aluminum box. Three of the boxes containing tubercle cultures, two of the guinea pigs and the box with the toxin were placed under the full influence of the rays generated by a four-inch spark coil and a good focus Crookes tube. It was necessary to stop the current occasionally, as otherwise there would have been danger of injuring the tube, and on this account, although the subjects of experiment were placed immediately under the Crookes tube for a working day of about 13 hours, they received only eight hours of actual exposure to the rays. Next morning two more guinea pigs were inoculated with the toxin, which had been subjected to the rays. The following was the result of the action of the rays on these guinea pigs: Two that were exposed to the rays after inoculation with twice a lethal dose of toxin lived, respectively, for 101 and 55 hours after inoculation. Two that were inoculated with twice a lethal dose of toxin, but not exposed to the rays, lived, respectively, for 120 and 76 hours after inoculation. Two that were inoculated with five times a lethal dose of toxin which had been subjected to the rays, lived, respectively, 45 and 60 hours. From the above results it is seen that the guinea pigs subjected to the rays lived actually a shorter time than the others, and that the toxin through which the rays passed did not lose its lethal properties. All the guinea pigs showed the ordinary signs of death from diphtheria toxin, the only difference among them being that the hair of those through which the rays had passed could be pulled out with unusual ease. The cultivation of tubercle bacillus all grew in the ordinary manner, so that they were evidently not affected by the rays.—*London Lancet.*

The earnings for May of the Edison Electric Illuminating Company of New York, including the high-tension systems, were as follows:

	1897.	1896.	Increase.
Gross.....	$188,739 18	$169,166 57	$19,632 61
Net.....	82,694 70	67,751 92	14,942 78
Gross, five months..	1,055,905 59	946,836 62	109,068 97
Net, five months..	508,509 26	427,120 60	81,388 66

Railway Master Mechanics Meet at Old Point Comfort.

The American Railway Master Mechanics' Association, which has a membership of 620, began its thirtieth annual convention at Old Point Comfort, Va., on June 15. The chair was occupied by President R. H. Soule. At the first session Col. Henry C. Hasbrouck, U. S. A., addressed the convention in behalf of the military authorities at Fortress Monroe. President Soule in his address recommended that a committee be appointed to report at the next meeting of the association on "The Use of Electricity For Motive Power Purposes."

A report was rendered by the committee appointed to consider the question of "Shop Motors—Steam, Air, Electric." Circulars asking for information as to the use of motors, including type, size, cost and efficiency, were sent out by the committee. One locomotive builder and 24 railroads replied, reporting that 36 steam motors, 172 air motors, and 229 electric motors were in use in their shops. The Baldwin Locomotive Works has in service 27 steam motors and 220 electric motors, thus showing that in the shops of 24 railroads there are 9 electric motors used as compared with 172 air motors and 9 steam motors. The committee found it difficult to secure data on the relative cost, from a practical standpoint, especially in the case of air plants. This was due, presumably, to the different conditions which would have to be considered. The committee expressed a decided opinion that both air and electricity possessed many advantages over steam for portable motors, and that there are circumstances existing where electric power is preferable for large permanent motors, for driving large tools, and where the convenient operation of overhead cranes is desired. For small portable tools the air motors were, in the opinion of the committee, more convenient if not as economical. The committee believes that with the exception of special cases a well designed air plant will be the most convenient and economical, all things considered, for general railroad work.

Among the electrical companies represented at this meeting were the General Electric Company, the Walker Company and the Standard Paint Company, of New York city, whose interests were in the hands of Mr. Frank S. DeRonde.

The W. J. Johnston Company to Dissolve.

The New York daily papers published last Friday a paragraph similar to the following:

"The W. J. Johnston Company, Limited, of 253 Broadway, publishers, applied to Justice Beekman for a voluntary dissolution of the company, and the order to show cause was set down for September 23. Liabilities, $3,420; assets, $8,930. The company was incorporated in 1889, with a capital stock of $25,000."

The W. J. Johnston Company is the publisher of the *Electrical World*. Mr. Johnston stated last week that the corporation would be dissolved as a matter of business convenience.

THE INDEPENDENT TELEPHONE CONVENTION.

A GATHERING AT DETROIT THIS WEEK.

As a sequence of the meeting at Chicago on May 27 of a large number of men interested in the independent telephone business, and according to a resolution adopted at that meeting, a convention of these interests is being held at Detroit this week.

One of the objects of this convention is the formation of a national association, including in its membership representatives of about 1,000 independent telephone exchanges now in operation in the United States.

Another object is the establishment of an independent long-distance service, and a third is "co-operation for resisting any action the Bell company may take in the courts in reference to the Berliner decision."

The meeting promises to be of great interest to every one connected with the telephone field and a full report will be published in the next issue of the ELECTRICAL REVIEW.

Electric Light Companies In Chicago Consolidate.

Four of the electric light companies on the South Side of Chicago have formed a consolidation, and will capitalize the new company, whose name has not yet been decided upon, at $2,000,000, the promoters of the deal being confident that from seven to nine per cent can be earned on the stock. The companies are the Hyde Park Electric Light and Power Company, the Thomson-Houston Electric Light Company, the Chicago Illuminating Company and the Englewood Electric Light Company. Seven hundred and fifty thousand dollars worth of bonds has been placed in the East, which will wipe out a floating indebtedness of between $350,000 and $400,000 and leave a surplus for improvements. An important consideration is the fact that the old companies mentioned got their charters from the town of Lake before its incorporation into Chicago. These charters are perpetual, and in case the fifth company, the People's Electric Light Company, should become a part of the consolidation, as the result of further negotiations, the resulting company, with its perpetual charter, would have a monopoly of the territory south of Thirty-ninth street, north of which the field is covered by the Chicago Edison Company.

The Boston *News Bureau* states that the American Bell Telephone Company is taking active steps against the independent telephone companies which are infringing the Berliner patent, there being three suits of this character now pending in the United States Circuit Court for the Southern Massachusetts district. The Bell company contemplates no action, however, against the users of telephones put out by the independent companies as has been announced. The American Bell company will strike at the root of the matter by proceeding against the companies infringing.

Telephone Suit In Alabama.

The Western Electric Company, of Chicago, began suit on June 19 in the United States Circuit Court at Mobile, Ala., against the Home Telephone Company of that city, with connections throughout Alabama and Mississippi, for an alleged infringement of the patents of Charles E. Scribner on switchboard improvements. The Home company uses a system under the Minnis patents.

PERSONAL.

Mr. Edward P. Ellicott was appointed city electrician of Chicago by Mayor Harrison on the 16th instant.

Mr. C. H. Florandin, of the C & C Electric Company, left New York Saturday for a tour of six weeks through England and the Continent.

Col. Sam Booker, of the Phœnix Carbon Manufacturing Company, St. Louis, was among the visitors to New York city last week, and renewed many of his old acquaintances.

Mr. F. W. Wells, former electrician with the Brooklyn Edison Illuminating Company, is now assistant general manager of the Manhattan Electric Light Company, of New York, and is a worthy and capable assistant to Mr. E. A. Leslie, the general manager.

Mr. E. C. Wilcox, of the Connecticut Telephone and Electric Company, Meriden, Ct., left Meriden on Saturday last to attend the meeting of the Independent Telephone Association at Detroit. Secretary Schofield, of the Phœnix Interior Telephone Company, left New York the same day, to be present at this meeting.

Mr. George Swinburne, general manager and engineer of the Melbourne Hydraulic Power Company, Melbourne, Australia, stopped in Chicago a few days last week, en route to London via New York. On his trip through the United States Mr. Swinburne will investigate the latest devices in the hydraulic and kindred lines, paying especial attention to electric elevators, which his company finds are fast replacing the hydraulic kind.

Mr. George A. McKinlock, president of the Central Electric Company, paid a brief visit to New York city last week on his return from Boston, where he had gone on business after attending the convention of the National Electric Light Association. Mr. McKinlock is one of the most prominent gentlemen connected with the electrical supply business, and is recognized as one of the hardest working members of the fraternity. Although he was compelled, on account of overwork, to take a rest of several months about a year ago, Mr. McKinlock is to-day enjoying better health and spirits than ever before, and is extending the business of his great supply company in new channels and conducting its affairs with a vigorous policy that is far-reaching and far-seeing.

THE NIAGARA-BUFFALO TRANSMISSION LINE.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, JUNE 9, 1897, BY J. G. WHITE.

The possibilities of the utilization of the almost infinite power of the mighty cataract, whose thunders are audible from this building, has been dreamt of and written about ever since the days when the old French monks first attempted to convert the Indians living in this and more western regions. A few days ago the speaker received a letter from Mr. Silas P. Dutcher, formerly Commissioner of Public Works of the State of New York, in which he dwelt on his personal recollections of the predictions as to the useful development of this power which the elder Roebling was wont to make some 46 years ago, while erecting the first suspension bridge over Niagara River, the successful completion of which did so much toward securing recognition of American engineering ability as belonging to the world's front rank. This letter spoke also of the fondness with which former State Engineer Evershed was accustomed to dwell on the possible development of Niagara's tremendous and untiring energy. A most fitting and enduring tribute to this same engineer (Mr. Evershed) is to be seen in the splendid plant of the Niagara Falls Power Company, some of his fundamental ideas as to its hydraulic development having been adopted by the Cataract Construction Company. This letter, written by the president of one of Brooklyn's most influential trust companies, illustrates the fact that we are living in an utilitarian age, and that others than engineers and manufacturers of machinery are interested in such developments as have for some years been going on in this neighborhood.

The character of this work, as exemplified in the power-house, switchboard and other details of the plant of the Niagara Falls Power Company, is such as to deserve the thanks of this association and all others interested in electrical development, on the ground that such working exhibits of high grade installations have a tendency to raise the standard of all future work.

The poetic, imaginative and prophetic features of a transmission line from Niagara Falls to Buffalo and more distant points have been thoroughly amplified and beautifully expressed, not only by such famous engineers as above mentioned, but more recently by such eminent men in our profession as Dr. Sellers, Mr. S. Dana Greene, Mr. T. C. Martin in his lecture, "Niagara on Tap," as well as by numerous members of the technical and general press. These features will doubtless be most aptly illustrated both in metaphor and on canvas, by the eminent electrical engineer of the Cataract Construction Company, in his lecture this evening, so that no attempt whatsoever has been made in collating this hasty sketch to accomplish the impossible task of vying with those gentlemen, even in a small way, by the slightest attempt at the imaginative.

My first personal knowledge as to the then proposed transmission line between Niagara Falls and Buffalo dates from the Autumn of 1894, when the White-Crosby Company was asked to prepare and submit detailed plans, specifications and proposal for its construction. It was then found that the engineers of the Westinghouse and General Electric companies had both recommended the construction of circuits of three wires, adapted to the three-phase system, each wire having an area of about 330,000 circular mils. Beyond this no definite plans had then been determined on. The engineers of the Cataract Construction Company at that time considered it advisable to have the line built entirely of iron poles, and, accordingly, detailed drawings and specifications were prepared and submitted, showing alternative plans. The first included two entirely independent lines of iron poles not less than 40 feet long, weighing something over 2,000 pounds each. The second consisted of lines of poles of about the same height, weighing about 1,000 pounds each, set in pairs and tied together by deep trusses, which served both as braces against the terrific wind storms which sometimes sweep across Lake Erie, and as a means of carrying part of the wires. A steel truss, fulfilling admirably this double function, was designed, which weighed about 600 pounds, the company's right of way being 30 feet wide, and the lines of poles located 15 feet between centers. Several wooden trusses were designed for the same purpose, but, while better from an electrical standpoint, these were all so clumsy in comparison to the iron poles that preference was given to the steel truss. Various designs of poles were considered, including several built up from "rolled shapes," final preference being given to plain tubular poles, on account of their ability to withstand equally strains from all directions, their appearance and the ease with which they can be kept painted.

Numerous designs for cross-arms were also considered, including those made from "rolled shapes," composite arms (part wood and part steel) and those made entirely of cast-iron or of wood. The latter two were preferred, on account of the ease with which they could be designed to accommodate either wood or iron pins.

In determining the details for these alternative plans it was assumed that poles would be set in concrete and spaced 100 feet apart; that each wire would weigh one pound per lineal foot; that the three wires composing each circuit were to be placed at the corners of an equilateral triangle having sides at least three feet long, and that the lateral strength of the line was to be not less than three times the forces produced by wind acting with a pressure at right angles with the direction of the lines, equal to 30 pounds per square foot on the projected surface of the poles, arms, insulators and wires, when the latter were covered with a coating of ice one-half inch thick.

As a matter of fact the heat generated by the current passing through the wires, together with the static effect tending to repel all particles of moisture coming in contact with the wires, this effect being quite noticeable on a 10,000-volt line, would combine to prevent the formation of any such coat of ice, unless at a time when current was off the line.

Any error thus introduced was on the safe side, and consequently not objectionable.

Full proposals with detailed plans and specifications for the construction above outlined were submitted October 11, 1894, and an amended proposition for carrying out the construction on the same general lines was submitted March 13, 1895. Nothing further developed in the matter until June, 1896, when new proposals were asked for the construction of the line on the assumption that white cedar, instead of iron poles, would be used throughout. Such proposal was submitted June 18 and accepted some days later.

In working out the details of the line as built, the same general assumed data above given were used.

When the route for the line was finally determined on, its length was found to exceed 27 miles, instead of being 25 miles, as previously assumed, and consequently the area of the wire was increased from 330,000 to 350,000 circular mils. The wire actually erected is composed of 19 strands, having a combined area of full 350,000 circular mils, and weighs nearly 6,000 pounds per mile.

In designing a transmission line the three most important factors probably are:

1. Its ability to carry its full load continuously and without interruption.
2. Cost.
3. Efficiency.

The first cost of power used to develop current for a transmission line is usually low, wherefore the efficiency of the line is not of primary, although of great, importance.

Those of us familiar with the development of the street railway motors have seen in practice an illustration of the fact that efficiency is not always a controlling factor. There has, probably, never been in general use another street railway motor so efficient as the Sprague No. 6, yet a distinct advance was made in sacrificing efficiency to mechanical strength and in subjecting track joints to what, at first, appeared to be an unnecessary, and certainly to be deprecated, wear and tear, in order to decrease the interruption to traffic.

(To be continued.)

Large Contracts.

Included in the contracts received by Messrs. McKenney & Waterbury, Boston, the past week, for gas and electric light fixtures, were large orders for new subway, Boston; Jackson, Mich.; 10 railroad depots in New England; Keith's new theater entrance building, and over 100 apartments in the Back Bay and suburbs.

The Gagnon Electric Railroad at Butte, Mont.

At the recent annual meeting of the Montana Society of Civil Engineers, President Herron described the Gagnon Electric Railroad, which the Colorado Smelting and Mining Company, of Butte, has the past year built to avoid the wagon hauls of its ores from the mine to the smelter.

This interesting work has a total length of 2.7 miles, says the *Engineering and Mining Journal*. At the Gagnon terminal is a tunnel 254 feet long through the waste dumps. This tunnel is on a 70-degree curve, and has a grade of three per cent. At the reduction plant terminal the concentrator bins are approached on a trestle with a grade of two per cent and a 65-degree curve. The maximum grade for loaded cars going out of the tunnel is three per cent. Empty cars returning up Montana street have a maximum grade of 10.62 per cent. This grade is from Park street to the mouth of the tunnel, and is operated by an electric hoist plant of two 15-horse-power Sprague double reduction motors, established at the mouth together. Each is supplied with two 15 horse-power motors, and power is furnished from the city electric plant. Track and wheel brakes are on each car, but the wheel brakes are ordinarily sufficient to control them, the track brake being used only in emergencies. The electric hoist will also probably be done away with, as the combination of the two brakes is found to be efficient, even on the 10.62 per cent grade. The road is owned by the Butte Consolidated Street Railway Company, the ore being hauled by them under contract with the Colorado company. Mr. F. W. Blackford had charge of the construction of the line.

Imperial Porcelain Works.

The Imperial Works at Trenton, N. J., present a lively and prosperous appearance at the present time, as indeed they have for some time past. The quality of porcelain for electrical purposes turned out by this concern ranks with the very best in the world, and its good qualities are highly appreciated by many electrical engineers. The selection of their porcelain insulators for use on the Niagara Falls-Buffalo transmission line was highly complimentary to the merits of their product, and the success with which the insulation of the line has been maintained is added evidence on this point. Recent enlargements and improvements in their manufacturing plant have given the Imperial Porcelain Works unsurpassed facilities for turning out promptly orders of any size for electrical porcelain. They are carrying a large stock of insulators of all kinds, and are in a position to fill orders on the day of their receipt. Several large contracts now in hand are keeping the working force fully employed.

The net income of the Chicago Edison company last year was $599,674. The company sold $2,267,000 bonds, with the proceeds of which it has retired $1,020,300 debenture bonds and expended $1,246,700 for purchase of additional land.

Electric Motors in Railroad Shops.

The use of electric motors in railroad shops is extending as the advantages which electric drive presents over steam or compressed air drive for the heavy machinery to be found in such shops are being brought home to those who have them in charge. Instances are multiplying throughout the country of the installation of electricity in lieu of steam or compressed air. Without assuming that electricity is the panacea for all the troubles connected with the drive of railroad shops, there can be no doubt that the advantages which its use presents are such as to compel attention. The motor may be placed in the most convenient position, whether on the floor, on a shelf, or suspended from the ceiling; it does away with the steam pipes and the troublesome exhaust, and with the compressed air pipes and the equally troublesome heating apparatus; it abolishes the big main belt and relegates the prime motor to a position far removed from the shops themselves, where the danger of fire is lessened and, consequently, the insurance rate reduced; the attention demanded by the electric motor is so slight as to be almost negligible, and last, and perhaps the most important, the power consumed is directly proportional to the work done.

Electricity is used to drive all the machinery in the shops of the Northern Pacific Railroad at Edison, in the far West. Recently the completion of the long-distance transmission line between Folsom and Sacramento, Cal., has placed it within the power of the Southern Pacific Railroad to use motors in their shops at Sacramento with most satisfactory results. In their operation the motors have already shown considerable economy over that by the original steam plant, which they superseded. The motors are placed in the shops where steam engines had previously been used, and the difference between the results, obtained apart from the mere question of economy, is marked.

Three motors are used; the first, a direct-current motor placed upon a transfer table used for shifting the locomotives. The motor is a G. E. 800, similar in every respect to those used on the ordinary trolley car, and it is driven by 500-volt railway current from the station. It is so geared that it operates not only the table, but also drives a drum carrying a wire cable used to haul the locomotives upon the table. This it does with perfect ease, hauling all sizes of locomotives. Instead of taking the current from the overhead wire by means of a trolley, the conductors are laid in an underground conduit and the contact is made by means of a plow running in this conduit. Some fears were at first expressed as to the result in rainy weather, but although considerable rain has fallen since the installation of this motor, no difficulty has been experienced. The transfer table and motor are shown in Fig. 1.

The motor used to operate the machinery in the boiler shop, as well as in the tender shop, is a 50-horse-power motor driven by 440-volt current from the step-down transformers. The machinery in these shops is peculiar, in that each machine is provided with a heavy fly-wheel for carrying it over the sudden shocks which occur in punching and shearing and similar work. For three or four minutes the motor has an excessive amount of work thrown upon it in starting the machine from idleness and until the maximum speed is acquired. The load then drops to 30 horse-power. Such sudden drops as this are calculated to demoralize motors of ordinary construction; with the induction motor, the drop in the load is hardly noticed.

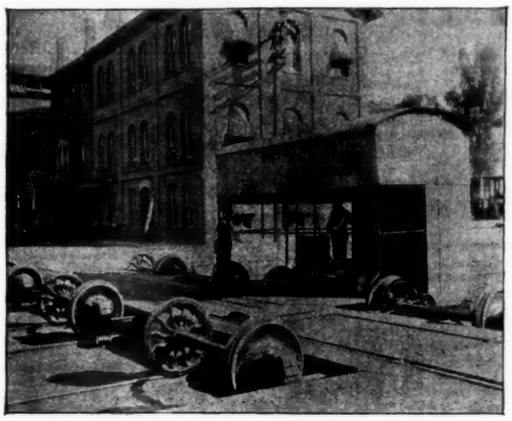


FIG. 1.—ELECTRIC MOTORS IN RAILROAD SHOPS.—TRANSFER TABLE IN SACRAMENTO SHOPS, SOUTHERN PACIFIC RAILWAY.

Fig. 2 shows the interior of the spring shop, driven by a 10-horse-power motor. This motor also has to cope with sudden heavy loads. In this shop all the springs—spiral, elliptical and leaf—used in the construction of locomotives, etc., are made, and the most difficult piece of work done is the making of the spiral springs, some of which come to the machine as a bar of red-hot iron one and one-fourth inch in diameter. This, placed in the machine, is instantly wrapped around a mandril, and it is such work as this that throws for a few seconds an enormous load on the motor. Although it has been in use for some time, it shows no sign of strain.

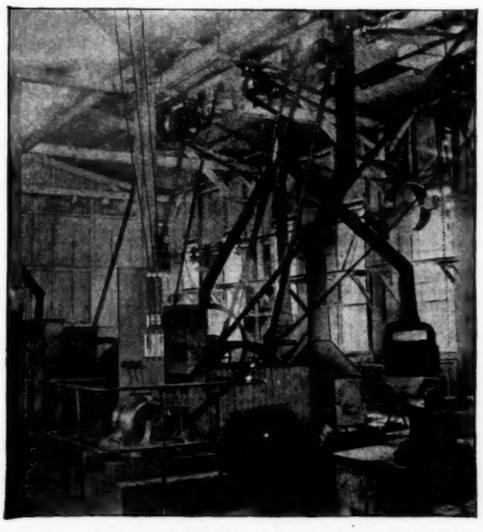


FIG. 2.—ELECTRIC MOTORS IN RAILROAD SHOPS.—INTERIOR OF SPRING SHOP, SACRAMENTO SHOPS, SOUTHERN PACIFIC RAILWAY.

The two motors last named are of the General Electric Company's three-phase induction type, without commutator, collecting rings or brushes. They are driven by 440-volt three-phase alternating current from the transformers, which step down the 11,000-volt current transmitted 24 miles from the generating station at Folsom. This installation is only one of many made since the completion of the transmission from Folsom to Sacramento, which latter city is rapidly becoming dependent on electricity as its exclusive motor power.

The Crocker-Wheeler Electric Company in Chicago.

The Crocker-Wheeler Electric Company has established a western office in a fine suite of rooms in the Old Colony Building, Chicago, where their business as manufacturers and electrical engineers, formerly conducted in that territory by Messrs. Sargent & Lundy, will be carried on. Mr. C. H. Wilmerding has accepted the western managership of this well known company as well as continuing as electrical engineer. Mr. Julian Roe has been detailed to this office as salesman. The customers of the company will in consequence of this arrangement have the advantage of dealing with the company and of obtaining direct the benefit of its well known guarantees and its engineering ability, and will have the convenience of direct telegraphic communication with the factory, located at Ampere, N. J.

TELEPHONE NEWS AND COMMENT.

At the recent opening of the St. Louis Press Club, congratulations from the Chicago Press Club were received by telephone, through the courtesy of the American Telephone and Telegraph Company, who installed special instruments for the occasion.

The annual meeting of the stockholders of the Erie Telegraph and Telephone Company was held in New York on Tuesday, June 8, president Levi Sprague in the chair. The following board of directors was elected: Abner S. Adams, Chas. E. Adams, Chas. J. Glidden, J. W. C. Pickering, Asa C. Russell and Levi Sprague, of Lowell, Mass.; Wesley A. Gove, Chas. S. Tuckerman and David S. Greenough, of Boston, Mass.; Harvey A. Whiting, of Wilton, N. H.; H. D. W. Burt and H. F. Stevens, of New York. The board of directors organized by the election of the following officers: Levi Sprague, president; Chas. J. Glidden, vice-president; Geo. B. Perham, secretary; Chas. A. Grant, treasurer; J. P. McKinstry, general manager.

A press dispatch from Philadelphia, under date of June 17, reads as follows: "The Philadelphia Standard Telephone Company, which secured a franchise to operate an independent telephone service, is reported to have entered into a contract with a New York banking firm to raise the capital to complete the work of construction in this city. The work was begun months ago with capital furnished by a construction company, but it was suspended on account of the business depression. The company, it is understood, intends to enter into rivalry with the Bell company and let the courts determine the validity of the patent rights it claims. The attorney for the company said to-day that the enterprise would shortly begin operating a local service."

A telephone company is constructing a 20-wire line from Chicago to St. Paul at a break-neck rate, says the *Telegraph Age*. Dynamite is used to blow holes in the ground. Hundreds of experienced men are engaged in the work, besides an army of teams. As the poles are erected a cable is run along over each of the two cross-arms. To these cables are attached 10 copper wires, and a team of horses takes the wires off 10 reels and up to the top of the poles at a sharp trot. The horses make no halt until they have drawn out the full contents of the 10 reels—about 80 rods a piece. Then the bunch of 10 wires is made fast and left for the splicing gang, while another 80 rod length is run out ahead. Gangs followed behind—as numerous as the poles would bear—attaching wires to insulators and putting the line in working order. The construction work is first-class in every particular, notwithstanding the speed and difficulties of all kinds encountered in the work.

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Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JUNE 23, 1897.

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We think the new design for a badge for members of the American Institute of Electrical Engineers a very neat and appropriate one. The various gentlemen who have labored in securing this emblem of good electrical standing are deserving of congratulation, and particularly is this due to Dr. S. S. Wheeler, who was chairman of the committee that finally designed and proposed the badge that was selected.

Not a few lines of care are to be observed on the fair young faces of telephone girls. The situation is most trying, the impatience of many telephone users being irrepressible and keeping the girls in a constant state of anxiety to please. Patience is the cardinal virtue in the telephone exchange, and forbearance ought to be that at the subscriber's end of the wire.

After years of objection, it seems that the electric headlight for locomotives is well on the way to more general adoption. It has been simplified, made reliable, cheapened, and has proved to be a better safeguard on both straight and crooked railroads than any oil headlight can be. The electric headlight has prevented many accidents which might have been very costly, while it is not known that any accident has ever been caused by its use. Once generally adopted it will bring a good business to the manufacturers.

OUR CONVENTION ISSUES.

A matter for congratulation, which interests every reader and patron of the ELECTRICAL REVIEW as well as ourselves, is the success of our four National Electric Light Association convention issues and the demand for copies of the paper from all parts of the country. During the past 60 days the American News Company has increased its order for the ELECTRICAL REVIEW three times, nearly doubling it in each instance. Many compliments have been received on the manner in which we handled all the matter pertaining to the convention, and the avidity with which copies of the last four issues were sought shows that electrical people know where to obtain fresh electrical news interestingly printed. We congratulate our advertising patrons on the fact that so many of them seized the opportunity of placing their products prominently before the whole field before, during and immediately following the convention.

VESTIBULED TROLLEY CARS.

The Massachusetts Legislature has passed a law making it obligatory on all surface railroad corporations operating street cars in cities of less than 50,000 inhabitants to run vestibule cars in the inclement Winter months. If we are to judge by results elsewhere, the wisdom of such a law is doubtful and its operation a useless expense to the railway companies. The glass front of the vestibule is the objection, for two reasons: It gets covered with frost, rain or snow or moisture, and becomes a serious obstruction to clear vision on the part of the motorman. It acts at night, besides, as a mirror, reflecting back the light thrown out from the car. So serious is this that in many cases the management has been compelled to hang a curtain across the car door so as to keep the vestibule dark; but it is a doubtful remedy. The general result of a vestibule law has been, we believe, to increase the number of accidents.

If the law were amended to be something in line with the marine regulations compelling pilots to keep at least one window open to the air most of the objectionable features would be eliminated and a higher degree of safety assured.

NIAGARA FALLS POWER.

When one considers that in and around Niagara Falls their power is absorbed and distributed to the extent, actual and under contract with consumers, of well up to 25,000 horse-power, one is led to the question, Where on earth is there an equivalent under any conditions of comfort and cleanliness? Many communities exist, where in the aggregate a larger power is produced from coal, such as at Pittsburgh, Buffalo, Cleveland, Chicago and many other manufacturing centers. And some of our modern ocean "greyhounds" will exceed the figure; but all are accompanied by the inevitable array of cinders, soot, grease, dirt, heat and all the ills attendant upon the transformation of energy from coal. At Niagara Falls, by way of comparison, an enormous amount of power is produced and distributed to points of use, for all sorts of purposes, without a single cinder, particle of soot, dirt or heat; there is no noise of escaping steam, and none of the troubles of boiler cleaning, flue scraping, leaks in pipes—in fact, a first visit to this modern wonder will make the visitor think the millennium must be coming, and the thoughtful student will be apt to conclude that, wonderful as the falls are, their real significance is only now coming to be understood, and that their classification among the ordinary wonders of the world is no longer true.

Our esteemed contemporary, the *Electrical Engineer*, seems to be unduly excited over our brief comment on vacuum tube lighting as proposed by the Moore Electrical Company. One year ago, when very strong and unreasonable claims were made by our contemporary and the above company, we stated that the devices then used were incapable of life, and the correctness of our judgment is borne out by the facts now admitted by themselves. Our esteemed contemporary should have profited by this lesson, and we are grieved that we are again compelled to inflict a similar brotherly rebuke to these able editors and foretell the speedy abandonment of the ineffective devices which are now employed and which they once more herald as important advances. Time will bear out our statements. We are willing to abide the result.

No one can justly accuse us of tardiness in acknowledging merit, nor of failing to further honestly and conscientiously the interests both of the inventor and the public. Precisely for these reasons we take great pains to obtain information from the most reliable sources. Now when we learn that vacuum tubes operated with Mr. Moore's devices take from eight to ten times the energy that ordinary incandescent lamps consume for the same amount of light, and what is more, that the process, by its very nature, is unavoidably connected with such inefficiency, even though the devices attain ideal perfection, we can not, even to honor the opinion of the emotional editors of our contemporary, though it would give us much pleasure to do so, attach to such effort the commercial value they would give it.

MORE CONVENTION INCIDENTS.

ADDITIONAL ACCOUNTS OF OCCURRENCES OF INTEREST AT THE NIAGARA FALLS CONVENTION OF ELECTRIC LIGHT MEN, JUNE 8, 9 AND 10.

The Phillips Insulated Wire Company, Pawtucket, R. I., was represented by Mr. H. C. Adams, Jr., the secretary.

Mr. E. Ward Wilkins, of the Partrick & Carter Company, Philadelphia, was one of the prominent gentlemen in the Philadelphia delegation.

The Sunbeam Incandescent Lamp Company, Chicago, was represented by the vice-president, F. S. Terry, a gentleman well known throughout the electrical field.

Capt. Wm. Brophy is to be congratulated over the final adoption of his rules for safe wiring. His achievement was a great one, requiring a vast amount of intelligent work.

The Utica Electric Manufacturing Company, Utica, N. Y., the makers of lightning arresters, arc-knife switches, mast arms and specialties, was in evidence, Mr. M. J. Brayton being in attendance.

President A. A. Thresher, of the Thresher Electric Company, whose shops are at Dayton, Ohio, was at Niagara Falls for three days. This company exhibited a line of modern dynamos and motors.

Mr. A. G. Runnels, secretary and treasurer of the Automatic Circuit-Breaker Company, Newago, Mich., exhibited a line of this company's apparatus, which included several new forms of circuit-breakers.

Mr. Fred A. Gilbert, president of the Boston Electric Light Company, was warmly welcomed at this convention, and it was a very proper recognition of his electrical activity that placed his name on the executive committee.

A new fuse for short-circuit and overload protection was shown by the W. & W. Fuse Company, of Providence, R. I. The company claim that the fuse is capable of dissipating 100 kilowatts of electrical energy without flash, noise or smoke.

Mr. L. H. Conklin, superintendent of the electrical department of the Flatbush Gas Company, Brooklyn, attended his first convention, and will attend others. Mr. Conklin is much interested in the development of the electric light, though a gas man.

The inventor of the Chapman voltage regulator, Mr. W. H. Chapman, was one of the few Maine men present. The Belknap Motor Company, of Portland, the manufacturers, since the first introduction of this apparatus a short time ago, have equipped many electric stations.

There was quite an inquiry on the lips of a great many people as to where was Fred Royce. This active electrical gentleman (who has never voted in his life, as he has always resided in the District of Columbia) was greatly missed.

In addition to Mr. H. McL. Harding, the general sales manager for the Walker Company, the following gentlemen representing the company were at the meeting: A. F. Moore, of Pittsburgh; J. H. Gates, of Chicago; W. A. Johnson, of Toronto, and A. V. Abbot, of Cleveland.

Mr. W. J. Newton, of the Newton Appliance Company, New York, was called back to New York by urgent business after the first day. This company is having success with the new line of "Newton" switches and bugs, which are being well introduced to the electrical field.

Messrs. E. H. Bennett, president, and B. C. Kenyon, representing the Diehl Manufacturing Company, Elizabethport, N. J., were both visitors during a portion of the meeting. This company are the makers of the "Diehl" ceiling fans, now so universally used, arc lamps, alternating machines and the new desk fan motors.

Mr. W. L. Magden, editor of London *Lightning*, received a cordial reception from the American electricians at the convention. He possesses that characteristic, so rare in an Englishman, a keen appreciation of a joke. When some one gave him a wooden cigar to smoke he was greatly tickled at the pleasantry, and secured a number of the "sawdust" fillers to carry home with him as souvenirs.

The Bell Telephone Company, of Buffalo, N. Y., and the long-distance telephone officials are deserving of the thanks of the electric light men for their generous donation of telephone service at certain hours during the convention. This was a feature that was much appreciated, and was another proof going to show to what a great extent the telephone is entering into the business life of the country.

The interesting lecture by Mr. L. B. Stillwell, electrical director of the Niagara Falls Power Company, on "Niagara Power," was delivered to a full house in the Park Pavilion, Niagara Falls, Wednesday evening, June 9. The lecture was illustrated by stereopticon views, and was attentively listened to and closely followed by all present. A vote of thanks offered by Judge Armstrong, who paid a glowing tribute to the work of Mr. Stillwell, was unanimously extended.

Mr. F. A. Gilbert, of Boston, was kept busy explaining how he happened to break the arm of his treasurer, Mr. S. S. Sias, he continually asserting that it was the province of the president of a company, as he was, to remain above the treasurer, even when falling out of an upturned coach. He explained, however, that he did have his opinion of the ELECTRICAL REVIEW for publishing the fact a few weeks ago, and from the many times he had heard from it, and the way he found it posted in all the Boston clubs, he had come to the conclusion that the circulation of that journal was much larger than he had ever supposed.

Mr. S. M. Hamill, the general manager of the famous old Brush Electric Company, met friends of his company of many years' standing on all sides. No company ever engaged in the manufacture of electric lighting apparatus has a more extended *clientele* than the Brush company, and the product of no factory ever stood the test of time and long usage better than the output of this company. The demand for the Brush apparatus is steady and constant, and the modern large machines have power of increasing popularity. Mr. Hamill's wide acquaintance with the users of this company's product makes him a *persona grata* in a great number of the central stations and isolated plants of this country.

A party of gentlemen riding in an electric car on the Canadian side one afternoon when the convention was not in session, in appreciation of the excellent riding of a lady on a bicycle who passed them, lifted their hats and bowed their acknowledgments. The conductor of the car, after listening to their complimentary expressions, remarks: "She rides very well. That's my wife." The distinguished electricians were more than ever complimentary thereafter, and would probably have remained in ignorance to this day of the joke the conductor (who afterwards confessed to being a single man) played upon them had not a newspaper reporter caught a quiet wink from him, indicating a quiet appreciation of the confusion of the over-gallant "Yankees."

Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, St. Louis, with Mr. A. C. Garrison, of the same company, were visitors to all the sessions of the convention and Mr. Rhotehamel returned to St. Louis by way of New York, spending a week en route. The New York office of his company is in charge of Mr. R. B. Corey, who is very widely known in the electrical field. The Columbia incandescent lamp, through the able management of Mr. Rhotehamel, both in its manufacture and in its business presentation, has become a synonym for the word "quality," it having been the aim of the manufacturer at all times to manufacture the best incandescent lamp that could be made. While there has been a very decided decrease in the price of incandescent lamps, this company has never departed from this idea, and to-day its strongest claim is made in behalf of the quality of the Columbia lamp, which is probably more widely in use than ever before.

Railway Telegraph Superintendents Meet at Niagara Falls.

On the 16th of June, the Association of Railway Telegraph Superintendents held their sixteenth annual convention in the parlor of the Cataract House, Niagara Falls.

The first session opened at 10 o'clock in the morning, about 25 members being present, and considerable routine business was finished. In the absence of the president, George M. Dugan, of the Illinois Central Railroad, who was unable to be present, on account of business, the meeting was called to order by vice-president J. W. Lattig.

Owing to the slow arrival of the delegates, no session was held in the afternoon, those present preferring to visit the power district and to view the scenery about the falls and rapids.

Although no official programme was printed, the following list of very interesting papers was scheduled for the convention:

"Relays and Thin Resistance," by Thomas D. Lockwood, superintendent of the Bell Telephone Company, in Boston.

"The Apprenticeship System," by George C. Kinsman, of the Wabash Railroad, at Decatur, Ill.

"The Delivery of Commercial Telegrams at Railroad Stations," by L. H. Korty, of the Union Pacific Railroad, at Omaha, Neb.

"Railroad Telegrams," by C. Selden, of the B. & O. Railroad, of Baltimore, Md.

"The Telegraph," by A. R. Swift, of the Chicago, Rock Island & Pacific Railroad, of Chicago.

On the 17th the election of officers for the ensuing year resulted as follows: J. W. Lattig, of the Lehigh Valley Railroad, at South Bethlehem, Pa., was elected president; W. W. Ryder, of the Chicago, Burlington & Quincy Railroad, at Chicago, vice-president, and P. W. Drew was re-elected secretary and treasurer. Mr. Drew, who is connected with the Wisconsin Central, at Milwaukee, has been largely instrumental in the building up of the association to its present standing.

Owing to the nature of the business in which the members are engaged, it is always a matter of uncertainty as to how many delegates will be present at the associations meetings. Vacations, also, are so few and far between that as much pleasure as possible is obtained from the conventions by sightseeing and general jollity.

Many of the members remembered the warm reception which they had met with in Niagara Falls in 1890, and last year it was decided to hold '97's convention in that city, thus breaking the precedent, hitherto adhered to, of never visiting the same place twice. About 50 members were present this year and, in addition to the papers above mentioned, heard the report of a special committee appointed at the last meeting on "The Benefit of Low Resistance Relays in Heavy Railroad Wires." This was the most interesting topic presented, and was followed by a long discussion on points brought forward.

It was settled by vote that the next convention be held June 15, 1898, at Hot Springs, S. D., thus giving the western members an opportunity to be present.

After spending the afternoon in sight-seeing about the Falls and along the Niagara Gorge, most of the delegates left in the evening, business not permitting a longer absence from duty.

ABSTRACTS OF PAPERS READ AT THE TWENTIETH ANNUAL CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT NIAGARA FALLS, JUNE 8, 9, 10, 1897.

NOTES ON CENTRAL STATION DATA.

If we omit stations in larger cities, where the population is concentrated, and let our minds wander over the general run of stations situated throughout the United States, how many of these, if they were asked the question, "Does incandescent lighting pay?" could answer the question affirmatively? Suppose the stations that are at present supplying their respective cities and towns with arc lights should have this source of revenue taken away from them; what would be the result? Could they survive upon the incandescent lighting that they do, combined with the power that they furnish for stationary motors? I think we may safely answer, No. The money-earning factor of the station would have disappeared; there would remain but the chaff. From one quarter and another we hear rumors of this and that town deciding that they think it is for their best interests to become owners of their own electric light plants for lighting their streets; and no electric light station exists at present but is subject to this menace; a turn of the wheel may bring them face to face with a crisis of this kind any day. The stations were built in good faith, and the owners expect to obtain a fair return for their investment; such returns at the present time come largely from the fact that they have a contract with the city for arc lights, which yields them a good revenue and a fair profit on their investment, and in many cases the arc lighting is the only branch of the station that really pays, and upon it is thrust the burden of carrying the whole company. The incandescent lighting either does not pay expenses, or just barely does so, while in a great many stations the amount of power sent out over the lines for the operation of stationary motors is not enough to count as a very serious factor in the operating receipts or expenses. To bring incandescent lighting up to as profitable a basis as arc lighting is a serious problem, now that the people are accustomed to obtaining incandescent lights so cheaply, and certainly some stations are so situated that they can not do it; others can by making a fight for it. Certain classes of stations are still giving flat rates in many instances, and the solution of the problem for them is to change over to meters and make the meter price one that will be equitable, both to the company and to the consumer. Where the charge has been too high, there will be, of course, no opposition encountered to a reduction, and in such cases it will be necessary for each company to study the situation carefully and see whether it is wise for them to continue charging the high rate or to change over to a just rate, founded on a substantial basis, and give the customer the benefit of the reduction. In such cases it is a question as to what is the best policy for the company to pursue. If it be decided that it is good policy to make a reduction to an equitable rate, then on what basis shall the company work? The thought has occurred to me, that it might be wise for the convention to adopt what may be called a standard rate, based on some factor or factors that will admit of application to every station in the country.

A careful analysis of the prices paid per kilowatt hour for incandescent light in different sections of the country seems to show that, in many instances, prices charged are based upon what somebody else has charged, rather than on what ought to be charged, in view of the cost of the principal items entering into the operating expenses at each particular place. The two main factors that enter into operating expenses are wages and coal. If we separate wages into their natural subdivisions—administrative, distributive and productive—we find the amount expended directly for producing the current to be the dominating one in the matter of the cost of furnishing current to the consumer. Comparing the productive wages, we find that in different sections of the country there is very little variation in the amount paid to the engineer, to the fireman, to the coal-heaver and the auxiliary help in the machine room, so that for practical purposes it would not do to base the price of current on this factor alone. A glance over prices paid for coal in different sections of the country shows a very wide variation, and, at the same time, a consideration of the coal itself, as to its quality, shows a variation in evaporative power per pound of coal; which variations ought, strictly speaking, to enter as a factor in determining price.

In determining a base price which should be charged per kilowatt hour, it is necessary to start with some kind of coal at a certain price, and which enters as a certain per cent into the operating expenses. Each station has certain blanks which they use, largely with the view of enabling the superintendent or manager to determine the output and its cost, and it seems to me that the question of such blanks offers a fruitful theme for discussion. There are numerous blanks used in many stations that are merely for the purpose of keeping track of supplies, etc., and of which it is not necessary to treat, as each station manager has his own ideas on this subject, and they concern no one but his own company; but the question of blanks for showing output of the station and its cost is one that may well be discussed by the members of the convention, and an effort should be made to secure a standard set of blanks that will show these points in such a clear way that the information may be available for comparison and discussion in the conventions. I present herewith specimen blanks which show the system designed for our station.

Blank E is the superintendent's monthly report made to the general manager of large companies, but should be made out by superintendents of small companies also and filed in a book kept for this purpose, so that they may at any time turn to it and get any information that is desired, or make comparisons between the output and cost from month to month. The main feature of this blank is that in a comparatively small space it gives the total cost of operation of the station for the month, the total amount of supplies used, the output of the station, the number of new lamps, motors, etc., connected, and also the loss, if any, in either lamps or motors. From the office the manager will have the report of the amount billed out for the current used for incandescent and arc lamps and motors during the month, and, by comparing the two, can readily ascertain whether the business for the month, as a whole, has been conducted on a profitable basis or at a loss; whether there has been an increase in the business; whether too much has been expended in one direction and not enough in another, and, in fact, can, in a brief space of time, analyze the entire business for the month in such a way as to give him the information that he needs, in order that he may intelligently conduct the business to a successful issue.

E

THE ELMIRA ILLUMINATING COMPANY.

SUPERINTENDENT'S MONTHLY REPORT. MONTH OF .....189 .

	RECEIVED				CONSUMED			
Article	Am't	Cost			Am't	Cost		
Coal								
Waste								
Water								
Arc Globes								
Dyn. Sund.								
Engine Sund.								
Station Sund.								
Cylinder Oil								
Engine Oil								
Grease								
Carbons.								
7-16x12 c. c.								
7-16x12 Pl.								
7-16x7 c. c.								
7-16x7 Pl.								
5-8x12 c. c.								
5-8x12 Pl.								
Lamp Renewals.								
10 c.-p.								
16 c.-p.								
25 c.-p.								
32 c.-p.								
75 c.-p.								
100 c.-p.								
Total				T't'l				

Productive Wages
Distributive Wages
Wiring Waves
Total Supplies and Wages

Station output in kilowatt hours: Arc ..... Power..... Railway..... Alt..... Total Kilowatt Hours

New Incd. Lps. Connected.....
New Arc Lps. Connected.....
New Motors in H.-P.....
New Fan Motors.....
Incd. Lamps Discontinued.....
Arc Lamps Discontinued.....
H.-P. of Motors Discontinued.....
Fan Motors Discontinued.....
Net Gain / Loss — Incd. Lamps.....
Net Gain / Loss — Arc Lamps.....
Net Gain / Loss — H.-P. in Motors.....
Net Gain / Loss — In Fan Motors.....

Correct.

.....Supt.

The President: The paper presented by Mr. Cahoon is now open for discussion by the members. Mr. Beggs, you have had a great deal of experience to my knowledge in the preparation of central station blanks.

Mr. Beggs: I understand that the matter of uniform blanks is to be discussed later in the meeting. I would say in a general way, however, that I thoroughly concur in the desirability of having uniform blanks. Much of the data that is obtainable in these associations is absolutely worthless for the purposes of the great majority of stations over the country. It is not applicable to their conditions at all. It has been my duty in the last 12 or 14 years to be interested in some of the largest and smallest stations; and the people running the large stations have no conception of the difficulties that the managers of these small stations have to contend with and how much more difficult it is for them to show results. In the preparation of any system of blanks it is very important that differences in condition should be made to appear; not only that the price of coal and the quality of it should be taken into consideration, but the type of the apparatus that is being used. This is a question that requires a great deal of consideration, and it seems to me it is one that would be well worthy of a special committee of this association. Some of the larger stations in the country have agreed upon and adopted uniform sets of blanks whereby the distribution of the various items of expense in the operation of stations are made exactly the same, and they exchange these blanks from month to month. There is nothing in the world better calculated to bring about an improved condition of station operation.

THE DAYLIGHT WORK OF CENTRAL STATIONS, BY T. COMMERFORD MARTIN, NEW YORK.

We have now had nearly 20 years of central station work in this country, and have witnessed an enormous growth in that period, but it is apparently true to-day that the companies restrict themselves injuriously in their natural and logical advance by remaining mere lighting corporations. What would happen to us all if some new lighting medium came into vogue that deprived us of our illuminating business entirely? If we had to fall back on daylight work, might we not be better off?

At the close of 1896 there were about 2,400 central stations in operation in this country, so that in 10 years the number had increased sixfold, a gain that is simply stupendous. Of these 2,400, however, 975 had, from the figures obtainable, no day circuits, and 220 others had only arc apparatus, so that 1,195 local companies were limited to night work. Of the remaining 1,200 companies, only 327 report day circuits, and if it is safe to assume that half of the 900 companies and plants not giving these details were without day circuits, it would appear that, out of 2,400 local plants, at least 1,500 are limited to the night hours for their earning capacity. It must be noted, however, that nearly all the 900 companies not specifying day circuits are operating incandescent circuits, very largely with the alternating current, so that the means for day operation are generally there under more or less favorable conditions.

It is obvious that an immense amount of capital and machinery is standing idle that might otherwise be productive of profit and dividends. Of the 1,200 companies confessing that they have no day circuits, only some 780 give their figures of capital and generating capacity in steam or water. It would appear that these plants, with a moderate capitalization of $46,908,000, and with an engine and water-wheel capacity of 164,000 horse-power, are standing idle two-thirds of the day and often a great deal longer.

It might be said that, in a general survey, four new factors have presented themselves in the last 10 years for the consideration and approval of the central station manager. These are motors, alternating current supply, storage batteries and electric heating. The alternating current is, for most stations, still restricted to night work, and will be, probably, until more single-phase motors of successful character are on the market.

Allusion has already been made incidentally to motor work. What is possible in this direction is best judged from what the large stations do. The following are figures of a large western central station, showing the horse-power of motors connected to the circuits, and the percentage that the power consumption bears to the total output. The data come down to March 31, 1897.

LOW TENSION.

Power connected April 24, 1897	5,396 horse-power.
Power per cent of the total output	23.1 per cent.

HIGH TENSION.

Five hundred-volt power connected April 24, 1897	1,566 horse-power.
Power per cent of high tension output	21.4 per cent.

ALL SYSTEMS.

Power connected April 24, 1897	6,962 horse-power.
Power per cent of the total switchboard output	22.8 per cent.

Another example is to be found nearer home, in the work of the New York Edison company. The motors to which that company supplied current from its distributing mains represented, on January 1, 1896, a total installation of 11,640 horse-

power. On January 1, 1897, the motors connected were the equivalent of 15,930 horse-power, an increase of motors connected in a single year of 4,290 horse-power, or 36 per cent. This does not include an installation equivalent to 1,142 horse-power in motors, to which current is supplied from the New York Edison stations during minimum hours, or for emergency and break-down connections. It will be seen that this brings the total horse-power in motors connected to the company's mains up to 17,072 horse-power. The average size of these motors is from three and one-half to four horse-power. Of the total motors connected it is estimated that about 5,000 horse-power, equivalent, is installed in connection with direct electric elevators and grip hoists.

In Massachusetts, where there is only one large city, no fewer than eight companies out of 58 are supplying power from their arc circuits; 18 from incandescent circuits, and 29 from independent power circuits; the total being about 14,000 horse-power of motors on the circuits. The asking rate for kilowatt hour averages about 20 cents, but runs down as low as 10 cents.

Turning next to storage batteries. What batteries can do is best exemplified by the Duane street station of the New York Edison company, one of the biggest stations in the world, with an engine and generator capacity of 20,000 horse-power. The load during minimum hours, I am told by Mr. J. W. Lieb, Jr., the general manager of the company, is such that it can be supplied in that period from the storage battery annex at the Bowling Green Building in the southern tip of the tongue of Manhattan Island, or from the storage battery plant at the Twelfth street station, either alone or in conjunction with current supplied from the Twenty-sixth street station over the feeder tie lines. The supply of stored current from the batteries in the annex stations during the minimum hours enables the big Duane street station to be shut down every night from 10.30 P. M. to 5 A. M.—nearly seven hours; and on Sunday the operation of the generating machinery at Duane street is limited to one watch. I do not hold a brief for storage batteries, but in view of such facts it is hardly possible to do other than press their claims on the attention of central station managers.

A word in conclusion as to electric heating. In central station work, we can and must recognize but one tendency as the underlying and ultimate; namely, to increase the demand for current; and whatever does that is to be welcomed.

It is said that, with current sold on the basis of 20 cents a kilowatt hour, no business can be done in heating, and that, even if the price be cut in two, the inducement to possible customers is not great. If this were true, the matter of price might forbid the operation of a single fan motor from central stations. Making a rough calculation of one cent per hour for the ordinary fan motor, that is 10 cents a day for 10 hours' steady running, or, say, $3 per month, or $36 a year. Allowing 12 such motors to the horse-power, the local companies are selling current to thousands of willing customers in the Summer time at the rate of $430 a year per horse-power, for a working day of only 10 hours. Other quotations can be made showing the high price got readily for current in small quantities from purchasers who are perfectly satisfied with the bargain, and find it pays them also very handsomely in some element of comfort, pleasure, convenience or even economy.

From these crude remarks of mine it will be seen how sadly tentative and experimental the art of electric cooking is for most of us; but is it not the duty of the local lighting companies to go into this matter and see how far they can foster the new art by introducing the apparatus and furnishing current for it cheaply? Even if the price falls short of $430 per horse-power per year, for 10 hours a day only, they should not feel discouraged.

Our esteemed ex-president, Mr. J. I. Ayer, who has placed at my disposal much interesting data that I can not produce here, for lack of time, gives me also a variety of information as to work that has lately fallen within his sphere of practical attention as representative of a large electric heating company. Their work includes a wide extent of shoemaking machinery, heated silk-finishing rolls, leather-working machinery, 387 curling-iron sets in the dressing rooms of the combined Waldorf and Astoria hotels, in New York city, 72 sets in the Parker House, Boston, and apparatus in the Plankinton and Pfister hotels, Milwaukee, as well as on the American line steamers across the Atlantic. It would not be fair to omit the 14,000 car heaters installed, of one make alone, in the past year and a half. A blank-book manufacturer has had in use since 1894 from 35 to 40 electric glue pots, and Duryea & Company, the starch-makers, are also users of electric heat apparatus. In Knabe & Company's piano factory, at Baltimore, twenty electric heaters have recently been placed; and there is a long list of clothing houses throughout the country that use electric irons. The same is true of vulcanizers for bicycle tire agencies and factories, while irons in large numbers have been supplied to State asylums in Indiana, Michigan, Wisconsin, Illinois, New York, Massachusetts, Maine and Maryland. It is simply impossible that all this apparatus should have been put in, unless it was economically or practically worth while; and this being so, is not the electric heat field one in which the local companies can now begin to work with advantage? Surely, here lies opportunity of the largest kind, to help the introduction of apparatus that must serve as a large customer for current at all seasons of the year.

REPORT OF THE COMMITTEE ON DATA.

Mr. President: For a number of years this committee made reports of the cost of electricity in pounds of coal as shown in actual practice, the information having been obtained by correspondence.

Following the instructions of the last convention, the committee have confined the work for the past year to the personal investigations of an expert, and on this basis this report is respectfully submitted.

It is to be regretted that a large majority of station managers do not desire to have their work made generally public, and, as usual, the efforts of the committee have been handicapped by this feeling. That a free interchange of experience would be vastly beneficial is clearly proven by the superior results obtained from the organized effort in this direction among the Edison companies.

We have called our expert, Mr. F. R. Low, therefore, to consider in detail the various losses which came under his observation, and have endeavored to cover as wide a range of equipment as was possible under the circumstances.

With this brief explanation the subjoined report is respectfully submitted.

H. M. SWETLAND, Chairman.

ABSTRACT OF REPORT.

I am asked to account for this difference between the actual efficiency attained in the every-day practice of electrical stations and the efficiency apparently attainable in other applications of power.

The question becomes one of accounting for the difference between results obtained by a high-class engine, running under test conditions, and those obtained by an entire station, under running conditions involving not only the decreased efficiency of the units under unfavorable load conditions, but all the standing losses of the station, inferior fuel, etc. The difference will be made up mainly from the following items:

1, decreased boiler efficiency; 2, lesser normal efficiency of engine; 3, impaired conditions of engines; 4, unfavorable engine load; 5, leakage; 6, condensation; 7, auxiliaries; 8, heating.

Much has been said of the disadvantage under which electric light stations labor on account of the wide difference between the minimum and the maximum loads, and thermal storage has been suggested as a means of evading this loss of efficiency. It is quite possible that this loss has been overestimated, so far as the boilers are concerned.

The capacity of a boiler is determined by the amount of water which it will evaporate in a given time; its efficiency, by the combustible required to evaporate a pound of water from and at 212 degrees. To determine how the efficiency varied with the rate at which the boiler was run, within limits, I have plotted the water evaporated per hour per square foot of heating surface, and the pounds of water evaporated from and at 212 degrees per pound of combustible, as determined by 30 different tests on Babcock & Wilcox boilers. If there were any decided tendency for the efficiency to follow the rate of evaporation within the range there covered, it might be expected to show itself here, but it will be seen that practically as good results are obtained at over five pounds per square foot of heating surface as at 1.75 pounds, and the intermediate tests show no dependence on the rate of evaporation. I have plotted in the same way all the tests of which I could find a record, and in this wide range still no evidence is apparent of any dependence of the boilers represented on the rate of evaporation within the range covered. This means that the variation of efficiency of boilers within the range here comprised is less than the variations due to different firing, etc.

It has been a matter of surprise, in following out this investigation, to find so moderate a difference between the performance of the boilers reported for long periods under widely varying capacities, and charged with all the coal used for banking, etc., and their normal efficiency under test conditions.

In comparing the duties attained in practice with the high standard established, it must not be forgotten that the standard was attained with one of the best steam coals procurable, with less than six per cent of ash-pit refuse. The results which we are comparing with this were obtained in many instances with coals having a much lower evaporative value per unit of weight, while their evaporative value per unit of cost may have been higher. Where the grate surface is ample, a very cheap grade of fuel can be used with a considerable reduction of the cost, and it is suggested that an economical advantage may arise from using two grades of fuel in plants that run long hours with widely varying loads; a good steaming coal with which the boilers can be forced at the time of overload, and a cheap small coal which can be used to advantage on the otherwise spare grate surface when the load is below the average. The efficiency of the boiler demands special consideration, for it affects directly the whole efficiency. Inefficiency in an engine affects only the steam which it uses, but inefficiency in a boiler affects the cost of all the steam produced for all purposes.

In the exigencies of central station work, it is not possible always to keep an engine tuned up to its condition of maximum efficiency, and managers of stations will readily recognize that some of their units, if tested just as they are running, would, from one cause and another, fail to realize their best efficiency. Valves and pistons become worn and leaky, valve setting gets out of adjustment, stuffing boxes leak, not only wasting steam, but impairing the realized vacuum and increasing the work of the air-pump. Notwithstanding these derangements, the engine must be kept in commission, and its average efficiency for the year is sure to be below its maximum efficiency, as determined by a test when it is in its best possible condition. It is the average efficiency of many engines working under these disadvantages that we are comparing with the maximum efficiency of an engine to every detail of which expert attention had been given.

It would seem as though every station manager would know the most efficient rate of output for each of his units, and how badly they suffered from a departure from this rate, but I found this to be in no wise the case.

The station that has a constantly changing load is at the worst disadvantage from inadaptability of units. The "load factor" proposed by Compton, expressed by the ratio of the area within the load line to the area of the containing rectangle, is not a fair expression for this disadvantage; for of two stations, each having a "load factor" of 60, for example, and one running six-tenths of the time on uniform load, and the other all the time on a constantly changing load, the first will be at a decided advantage in this respect. Its units, if adapted to their output, can be run at their maximum efficiency, and the station is better off even than a cotton mill, or other factory with a steady load, for it has a long run without interruption. It is to the fact that its load-line approximates more nearly this condition that the exceptional efficiency of the Brooklyn Edison No. 2 station is due, and that an arc station is able to run at a less coal cost per unit of output. With a changing load, however, the units are at their maximum efficiency only momentarily.

It is quite likely that the importance of the impairment of efficiency from this cause has been overestimated. If all the engines in the station ran all the time at half load, the impairment would be less than 33 per cent, and if they ran all the time at 50 per cent overload, the impairment would be only eight per cent.

A. G. Pierce and R. S. Hale, who have made a careful study of the Boston stations of the Edison companies, say: "In our test we have finally found the variation due to causes which we first thought negligible, to be more than the variation due to change in load. As a matter of fact, the steam per indicated horse-power in our two 200 units holds within 12 per cent over a range from one-quarter up to full output."

It is probable that the loss by leakage is greater than is generally supposed, and when the steam supposed to have been consumed is determined by the water-meter, leakage, either in the form of water or steam, counts against the engine. In a surface condensing plant, if there were no loss by blowing off or leakage, no water would have to be supplied to the sys-

tem after it was once charged. As a matter of fact, a constant supply is necessary. At one of the stations visited the leaks were about 2,000 pounds per hour in the Winter time, and in the Summer, with one-half the engines, two-thirds the boilers and all the heaters shut off, they were about 500 pounds per hour; in another they were 3,500 pounds per hour.

All the water evaporated by the boilers does not reach the engine in the form of steam, considerable being condensed in the conducting pipe. In a test this is allowed for and only the dry steam charged to the engine. Recent experiments have shown that each square foot of bare pipe exposed under average conditions will condense .85 of a pound of steam per hour. It would take at this rate only 15 square feet to consume a horse-power (i. e., 13 pounds of steam). Even when covered with a non-conducting material, this loss is considerable, when it is considered that not only the pipe, but all heated surfaces, are contributing to it. If we allow the surfaces only one-fifth of this on an average, on account of many of them being covered, we shall still lose one of our standard horse-powers for every 75 square feet of steam-containing surface.

A large amount of steam is used by the auxiliary engines about a station. While it is true that the boiler feed pumps, for instance, develop little power as compared with that of the main engines which they supply, they are, as a rule, very extravagant in the use of steam. The same thing is true of the ordinary independent air and circulating pump. There are also in many stations small engines used for operating automatic stokers, fans for artificial draft, coal handling machinery, etc., the aggregate steam consumption reaching a very considerable figure. The steam connections to these auxiliaries add very materially to the complexity of the piping system and increase the leakage and condensation losses. There is a movement in the direction of replacing steam-operated auxiliaries by those operated by electric motors, reducing the piping system to the utmost simplicity. At a cost of, say, 20 pounds of steam per indicated horse-power, and a loss of 50 per cent in its electrical transmission and re-development, one would have, at the point of application, only 40 pounds of steam per effective horse-power, against the 75 or 200 pounds required by the steam motors, displaced, to say nothing of the reduction to be expected in the radiation and leakage losses.

In the following table I have undertaken to show, for the few stations from which reliable data have been procurable, the proportions which the various demands upon the coal pile bear to each other and to the whole. The column headed "efficiency" shows the percentage of the coal actually used that would have been used by the standard equipment (10 pounds of steam per hour and the electrical horse-power .85 of the indicated). Under "engines" is the percentage of the total coal consumed by reason of the lesser efficiency of the engines; under "conversion," the percentage of the coal consumed by reason of the conversion losses exceeding the standard. The next three columns give the percentage of the total coal used to supply leakage, condensation and auxiliaries. The column under "boilers" gives the percentage by which the consumption was affected, by reason of the fact that the boilers evaporated more or less than 10 pounds of water per pound of coal, while the column of "unassigned" gives the aggregate of all the losses not separately reported.

No.	Hours Run.	Results.		Efficiency per cent.	Percentage of Coal Used for						
		Lbs. coal per kilo-watt hour.	Watt hours per lb. coal.		Engines.	Conversion.	Leakage.	Radiation.	Auxiliaries.	Boilers.	Unassigned.
1	24	8.30	120.5	24.09	20.95	.24	.....	.....	.....	19.91	34.79
2	6-12	6.24	160.3	32.05	27.30	3.63	.....	.....	.....	26 98	10.04
3	24	3 71	269 5	53.91	9.03	.....	11.63	.....	.....	19.98	5.45
4	24	4.56	219.7	43.86	5.88	2.13	<—12—>		.....	25.00	23.11
5	23	8.69	115.1	23.01	24.97	6.95	.....	.....	.....	.4	32.66
6	24	3.82	262.	52.10	8.80	5.03	.....	4.00	.....	.....	30.07
7	24	8.91	112.2	22.45	22.56	5.50	.....	.....	.....	38.60	10.89
8	14-20 Av. 17	8.67	115.3	23.07	.....	.....	.....	.....	6.04	39.60	31.28
9	24	6.64	150 6	30.12	30.12	21.50	.....	.....	.....	1.70	17.56
10	24	8.62	116.	23.20	24.12	7.5	.....	.....	.....	1.50	43.67
11	24	10.13	98.7	19.74	9.27	.....	.....	.....	.....	42.50	28.49
12	24	7.45	134 3	26.85	38.22	.....	.....	.....	.....	18.60	48 53
13	12	7.33	136.5	27.29	11.45	.....	.....	.....	.....	25.00	36 26
14	24	5.68	176.2	35.21	10.64	1.07	.....	.....	5.30	10.00	37.77

In the following table I have undertaken to show, for the few stations from which reliable data have been procurable, the proportions which the various demands upon the coal pile bear to each other and to the whole. The column headed "efficiency" shows the percentage of the coal actually used that would have been used by the standard equipment (10 pounds of steam per hour and the electrical horse-power .85 of the indicated). Under "engines" is the percentage of the total coal consumed by reason of the lesser efficiency of the engines; under "conversion," the percentage of the coal consumed by reason of the conversion losses exceeding the standard. The next three columns give the percentage of the total coal used to supply leakage, condensation and auxiliaries. The column under "boilers" gives the percentage by which the consumption was affected, by reason of the fact that the boilers evaporated more or less than 10 pounds of water per pound of coal, while the column of "unassigned" gives the aggregate of all the losses not separately reported.

Mr. Swetland, after reading, in continuation, said: I wish to say further, in presenting this report, that I feel that during the past six years that this work has been in my hands that there has been, perhaps, some good work done for the association. We have stimulated in some cases an exertion to better work, I am sure. I do feel, however, that the work has not produced the result, and this report does not show the results, which I hoped to present to you. There is this to contend with in the work. In the first place the station manager does not like to have his private work laid before the public; and I feel that in a public convention of this kind we can not get for distribution such a report as can be obtained by associations where the work is more private, as perhaps the Edison organization. It seems to me, therefore, that in future the conduct of this work would perhaps be better confined entirely to the hands of the secretary, letting him secure such information as can be obtained by correspondence, without any further expense to the association. I desire to thank the members for their co-operation in the work, and I feel that they have done all that could be expected, and for my part, I have done my best to serve you. Mr. President, it is not necessary to read the report, perhaps?

The President: No, I think it is unnecessary, Mr. Swetland, because it has been in the hands of every active member for some weeks past. I think it is my duty to advise the association of the very great interest that has been taken this year by Mr. Swetland in the preparation of this report. We have had several interviews. He has visited me at my home in Toronto, and I have made several trips to New York to visit him in connection with other association matters, and we have tried to devise a plan whereby we could make this report much more interesting than ever before. We appreciated the fact that if you ask people to do anything voluntarily it is sometimes apt to be neglected, and so we decided, in our efforts to make this report appear before our members in a manner that would be satisfactory to us, to engage an expert gentleman to visit the different central stations, to secure and give this information at first hands. However, while I think we have a much more interesting report than we have had in the past, it is not satisfactory, and I doubt very much the wisdom of continuing this particular committee. The central station managers—and I can hardly blame them—are more or less diffident about giving to this association the information, the actual private information, as to cost and maintenance, etc., with which it can only be as valuable as such a report ought to be. However, the matter is in your hands. If some gentleman who is acquainted with the work of the committee will move for its discharge, or for its retention, either one way or the other, the question will be taken up.

A Member: I move that the committee be discharged. Carried.

Lighting Cars by Electricity.

A system for lighting railway cars by electricity has been given a practical test by the Pullman company. The mechanism of the apparatus is very simple. A plain gear wheel attached to the car axle drives a pinion on the shaft of a one-horse-power dynamo secured on the car truck. The current generated is passed through a small storage battery, whereby the light is rendered brilliant and uniform, both while the train is running and when it is standing still. Each car is thus independently provided with its generating and illuminating apparatus, so that cars may be detached from through trains, when desirable, and sent over connecting roads without limitation. The apparatus weighs less than 500 pounds, and is automatic in operation, thus requiring no personal attention, except at long intervals of time, when regularly inspected at terminal stations.

Broken Glass or X Rays?

One William Leary, of Oakland, Cal., who ate large quantities of broken glass and stated that it was his sole food, has begun suit for damages against Dr. O. D. Hamlin for injuries alleged to have been inflicted by exposure to the X rays. After the boy had partaken of some glass, at his request, the doctors examined him by means of the X rays to see how his interior mechanism worked. He now claims that he was injured. The doctors are inclined to believe that his peculiar diet caused the trouble.

A war ballad by Helen Gray Cone, particularly appropriate to Gettysburg week, appears in the July *Scribner's* under the title "Greencastle Jenny." It narrates a chivalrous episode of the march northward of Pickett and his Virginians in 1863.

THE DIRECT CONVERSION OF HEAT INTO ELECTRICITY.

ADDRESS DELIVERED BEFORE THE NEW YORK ELECTRICAL SOCIETY, THURSDAY, MAY 20, 1897, BY H. BARRINGER COX.

(Concluded from page 291.)

Mr. Cox: I have Weston instruments here—a volt and ammeter. Let some of you gentlemen tell me how many watts there are. I have traveled all over the world, and found the electrical watt, as apparently indicated by my machine, as distinctly different as are the characteristics of the people. [Applause.] What is the watt? Let some one say. Is it necessary to put anything in circuit to find the watt? I think it is sufficient to take the reading of these two instruments here, the voltage and the amperage. Why is it necessary to put anything in circuit in order to find the watt efficiency of the machine? I came here to talk on thermo-electricity, not on electrical measurements. Wherein is the difficulty of making measurements when you have a Weston voltmeter and a Weston ammeter?

Mr. Dunn: A very simple way to measure the output would be to short-circuit the machine through the ammeter. Then we know when it is giving half the number of amperes it is giving the maximum number of watts at half the voltage on the open circuit.

Prof. Crocker: I have a few points to mention. One is, I think Mr. Cox is right in saying that there was no necessary disintegration in the thermo-electric pile. I have heard the statement made on high authority that there was an inherent deterioration; in fact, that the pile acted by that very deterioration; in other words, that its life was limited by its activity, and the more work it did the shorter its life. I do not think this is either theoretically or practically necessary. I do think, however, as Mr. Cox has said, that it requires a very perfect and perhaps peculiar mechanical construction to avoid the natural disintegration which is likely to occur when we join dissimilar metals. That sharp line of demarkation to which he refers, as is well known, tends to produce a weak point, and the elements are very likely to crack at that line of demarkation, but, by some particular construction, one or two of which he has indicated (and there are several others), we can avoid that, not only partially, but entirely. I am familiar with thermo-electric couples in use a year without any serious depreciation in value of their output, and, in fact, we have a battery in our museum in Columbia College which we have had for several years, not used constantly, but more or less, and, as far as I know, it is as good to-day as it was several years ago. That difficulty, I think, can be and practically is overcome.

In regard to the oxidation, I think that can be overcome by protecting the elements in some such way as Mr. Cox speaks of. In the case of the elements I speak of, each element is protected by a shoe, on which the heat strikes and that protects the element from oxidation. As to the output, as Mr. Dunn has said, the amperes on short circuit give twice the amperes registered when the external resistance equals the internal. At the same time we get only half the volts in the external circuit that we get on open circuit, and, therefore, if we multiply one-half the amperes given on short circuit by one-half the volts on open circuit, we get the actual watt output, which is the maximum to be obtained from any source of that kind, thermo-

electric or otherwise. I have tested some electric batteries repeatedly, and that has come out correctly. You also get half the voltage when you have the external equal the internal; half the total voltage is available from the external circuit. It is a well known fact, and is, of course, true in this case.

Concerning the hot and cold juncture or junction differing in temperature, I have observed the same fact, as stated by Mr. Cox, that if you reduce the temperature of the cool junction, and make it still cooler, you do not get a much increased electro-motive force. Mr. Cox interpreted that to mean that a greater difference of temperature does not give a greater electro-motive force. In that conclusion, from that observed fact, I do not agree, because I think it is a fundamental law that the electro-motive force is proportional to the difference of temperature. It is used in physics as an absolute method for the determination of temperature, and when it is used in low temperature it is even more reliable than a thermometer. The law is that the electro-motive force is in proportion to the difference of temperature. It is true of this battery as in every combination of thermo-electrics. I explain that phenomenon, which is undoubtedly observed, in this way, if you cool the junction having the lower temperature, the other one follows it down, and you simply have practically the same difference of temperature as before. You say, Why? Does not the higher temperature remain at that higher temperature? No; simply because it has a limited heating surface and can only maintain a certain difference of temperature between the ends, and, if one end is cooler, the other can only be the same number of degrees above it in temperature, and if the cool one goes down, the higher temperature then follows and maintains the same difference between the two ends, or substantially so. [Applause.] It always struck me that it does not pay to cool by water or otherwise the cool junction. I tried it and found if we drop cold water on the cool junction, or even put ice on it, there was no great increase in the electro-motive force. Therefore, I argued it was not worth while to complicate the device by attempting to cool the lower temperature junction. It has been suggested by Mr. Bradley, who is present, that the thermo electric battery is just like a boiler; that it has a capacity of output proportioned to its heating surface; in a boiler we have so many square feet of heating surface and there is so much possibility of producing energy. If more attention was paid to the fact, we might increase the heating surface of the battery, and get a greater difference in temperature, which I feel positive will give a greater electro-motive force. In regard to the small number of couples, Mr. Cox is right in preferring a smaller number, and, therefore, less complication, provided he does not need a higher electro-motive force. If it is necessary to have a higher electro-motive force, he suggests that it can be obtained by transformation. Unfortunately, the only way of transforming direct current now open to us, is by means of the motor-dynamo, a fairly good device, but having an efficiency of not much more than 85 per cent. and that is somewhat of a disadvantage. Perhaps it would be better to have a fewer number of larger couples, and sacrifice efficiency in order to get simplicity with a few couples. If I wanted a hundred volts I would rather get it by a sufficient number of couples rather than by a small number of couples and a motor-dynamo. I do not think the empirical method is always the best one, and I am quite sure that the watt is about the same here as it is elsewhere, and that there is an actual output there in watts which would be the same, measured under any reasonable conditions. I think the efficiency expressed in exact terms, however low it may be, is the thing for every one to consider, particularly any one studying the matter, and I feel that it can only be by gradual improvement in the efficiency, as we have seen in the case of the dynamo, working up from an efficiency of a thousandth of one per cent to an efficiency of 93 per cent and higher, and this has only been possible after slow and gradual improvement.

Mr. Bradley: As to the difference in the watts, is the machine irregular, or is the man who measured the watts?

Mr. Cox: It must be the machine. [Laughter.] One man will say four volts times four amperes are sixteen watts. Is it sixteen watts? Someone else says no; it is not sixteen watts, it is eight, because the external resistance and internal resistance must be equal, consequently the amperage is only one-half—then it should be four volts times two amperes equal eight watts. People will dispute the watt measurement in a primary battery, or in any other form of electrical energy. The same law which governs the output of this machine governs everything electrical which we have. There is nothing at all strange about it that I know of. I calculate the watt output of this machine by multiplying the voltage on open circuit and the amperage on closed circuit, and dividing the product by four—for instance, five volts times four amperes are twenty—divided by four are five watts.

Mr. Jones: What is the difference in the internal resistance with 75 degrees? Is it possible to put several of the machines in series like a battery, and will they act in the same way as the cells of a battery?

Mr. Cox: They can be treated exactly as though they were primary batteries; they can be put in series or multiple to any extent. Regarding the difference in resistance between the machine, hot and cold, we find it to be about three-tenths of an ohm to one ohm, if it has an internal resistance of one ohm cold it is about three-tenths of an ohm increase hot.

Mr. Jones: At 75 degrees?

Mr. Cox: Yes, about that, the ordinary temperature of a room. As close as we can estimate the increase is about three-tenths of an ohm. They can be put in series and multiple. They can be absolutely dead short circuited without any effect on them. It is nothing strange in the machine, but it is a very happy feature. They have fewer faults than any electrical device we know of, after the mechanical defects have been overcome.

Mr. Dunn: At the request of the President and Mr. Cox, I have tested this machine to get the watt output. I first connected the voltmeter across the terminals on the left-hand pole on open circuit, which showed a voltage of 2.6; with the leads there shown, I short-circuited to the ammeter, and got a current of 3.9 amperes. I took the half each of these values and multiplied them, and got an output of 2.53 watts.

Mr. Sachs: There can not be any conceivable variation in internal resistance with the variation in output. Is there a possibility of such a thing? It would seem to me, if this wattage had this erratic fashion of decreasing with the output, that there might be some change in the resistance of the thing, due to the output itself.

Mr. Cox: If there was a change it would be such a trifling matter that it would be hardly appreciable. You mean taking the current from the machine, the heat might affect the resistance—is that the point?

Mr. Sachs: The heat remains fixed, as I understand it. After you once heat up the machine it remains at that fixed temperature. By changing the current you change the temperature, and, therefore, change the resistance.

Mr. Cox: I do not think I said anything about changing the resistance. The resistance is judged by me by the ampere output when the machine is hot, and when cool by taking an ordinary bridge measurement.

Mr. Sachs: I understood you to notice a change in temperature that changed the current—increased the current.

Mr. Cox: By short-circuiting, which is changing the current directly back into the machine, that will raise the temperature of the machine.

Mr. Sachs: That is changing the temperature, and the temperature has changed the resistance of the couples—

Mr. Cox: I did not say so.

Mr. Sachs: That would be the natural result.

Mr. Cox: I do not think so.

Mr. Sachs: I want to know if I was correct?

Mr. Cox: I do not think you are.

Mr. Sachs: I think we ought to take a rheostat, in order to convince ourselves, and place the rheostat across the terminals, and put the voltmeter and ammeter in circuit.

Mr. Cox: I did not come here for scientific discussion of the watt as a unit of energy, or of electrical measurement. I came here to show you the practical working of these machines. I think you will be far more convinced by examining the machines than by discussing them. This machine, which Mr. Dunn says is only giving 2.53 watts, is running that fan motor. [Applause.]

Dr. Pupkin: I would like to say a word in support of Mr. Cox's views. I do not think the test which Mr. Dunn made is quite unobjectionable. I think where a battery can work with the expenditure equal to the supply, the theory is right about the watts; but suppose the battery gives current at a much larger rate, and does its work at a much larger rate than the supply of energy, then, of course, the voltage would drop. A battery is not the same thing when it gives this large current, as it is when it gives the small current. It is quite possible, if a thermo-electric battery is short-circuited, and gives a large current, that the gas jet is not capable of supplying the heat at the rate at which the electrical energy demands it, and the actual voltage of the thing drops, and then the battery would not work under the same conditions as it would work if the heat supply was large enough to keep the actual induced difference of potential constant. It is a fact similar to the polarization cell; and when I see this motor work at two and five-tenths volts, as stated, I do not believe that it can do it.

Mr. Mailloux: I do not think the Peltier effects should be neglected. As there is a self-induction in dynamos, so there is a counter phenomenon in thermo-electric currents, whereby the passage of the current changes the temperature. When you increase the current beyond the normal rate for which the instrument is designed, there would be a strong phenomenon which would act in a manner analogous to the self-induction and act as a counter electro-motive force. I think it is an effect which should not be neglected, and which would make the actual current smaller than it would be thought.

Mr. Bradley: Where the effect comes in within the legitimate electro-motive force, that passage of air due to the Peltier effect is the legitimate working of the machine. The reduction of heat is rapid, but the Peltier effect is within the electro-motive force, and is not discoverable after removing the direct electro-motive force.

Mr. Mailloux: It is a function of the current, just the same.

Dr. Pupkin: At the junction there will be a cooling off. That is legitimate. But, suppose that the heat supply is not such as to be capable of furnishing a surplus to the battery as such, and the length of the flame be such that the heat which is used up by the passage of the current is not supplied by the flame and not to the surface, you will have an actual drop in electro-motive force

The suggestion was made that Mr. Duun make a second test of the machine by placing the ammeter in circuit with the machine and motor as it was then running, and at the same time take the voltage from the terminals of the machine while the motor was in operation. This was done, and, at the request of the president, Mr. Dunn announced that he found the watt energy to be 3.70 watts. [Laughter.]

Mr. Cox: If any one can tell me what the real watt energy of that machine is I will be very much obliged to him.

Mr. E. E. Ries: I ask Mr. Cox whether he has made any experiments to determine how much of the heat which he supplies to the cell is converted into useful energy. It seems to me that, if this is a true thermo-electric cell, the amount of energy developed from moment to moment must vary according to the extent to which the energy is drawn upon. If that is correct the erratic action of the cell, so called, may be explained; that is to say, the watt output should be different under different consumption of flame. For instance, if you have the cell on open circuit, while the flame is burning full, the consumption may not be equal to the energy applied to the cell, whereas if the current is obstructed it requires, with the same uniform strength of flame, a different internal effect, and it is possible, from that point of view, that the behavior is different from that of the ordinary chemical battery.

President Emery: Mr. Cox stated that it uses two and one-half cubic feet of gas per hour, and that gives us this number of watts.

Mr. Leonard: It seems to me that neither the first method of arriving at the watt energy nor with the motor in circuit is the proper way. If we are going to reach a conclusion as to watt energy, we want something in the circuit which is not going to operate in the way of counter electro-motive force. Nobody would question the fact that a large storage battery, with a couple of volts might have a larger energy than that represented by the fan, and yet the fan would not take more than two watts run on the terminals of a storage battery.

Mr. Cox: The question of the output is one which I leave to you, gentlemen, entirely. It is utterly beyond me, as you can see, for me to say anything as to what the output in watts really is. It may even have grown, should we make another test, and be six or eight watts now. The question of watt energy is always in dispute, and I think this discussion fully bears out my statement, that I have found the watt as varied as are the characteristics of the people. I buy the best instruments money can purchase, but all I care for is how quickly, how cheaply and how practically I can make that fan motor go. [Applause.]

ABSTRACTS OF PAPERS READ AT THE CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION, HELD AT NIAGARA FALLS, MAY, 1897.

(*Concluded from page 273.*)

"THE STEAM END OF AN ELECTRIC PLANT," BY A. M. WICKENS.

If we expect any further economy we must look to the prime movers, or engines and boilers, for it, unless our electrical engineers can approach the glow-worm in efficiency, which makes its light with about one three-hundredth part of the force used in our ordinary incandescent lighting plants—or should the electrical engineer reach, in the near future, vacuum illumination, without incandescence, we should have a light at one-sixth or less of the present cost for power. But during the time these inventions are being perfected, we must do the best we can with our steam engine and boiler as prime movers in hundreds of our electrical plants.

By the highest engine efficiency yet attained, we use one and one-half pounds of coal per horse-power hour, or only about 17 per cent of the energy delivered by the boiler is converted into mechanical work. It is safe to say the average engine of the best makers, running in the electrical plants in Canada, requires at least three and one-half pounds of coal per horse-power hour, thus discharging into the atmosphere over 90 per cent of the energy supplied by the boiler.

The average evaporation with ordinary return tubular boilers does not exceed six pounds of water per pound of coal burned. If the boiler is well set and well fired an evaporation of eight pounds of water can be obtained. This supplied to an engine giving a horse-power for three and one-half pounds of coal per horse-power hour, would represent a water consumption, as per indicated card, of 28 pounds of water per horse-power, and is called good practice. If we increase the evaporative capacity of the boiler and evaporate nine or ten pounds of water we are making a great saving. Again, if we increase the efficiency of the engine until we only consume 15 pounds of water, we have also made a saving that will look well at the end of the year's accounts. Even with our best arrangements our heat losses are great, and engineers are looking for further improvements.

For the larger electrical plants—that is, those of 1,000 or 2,000 horse-power—we need hardly say very much, because they generally have some one at their head with sufficient engineering ability to make a fairly economical running plant—that is, if the board of directors will allow them to spend enough money for this purpose.

The smaller stations—and their number is nine-tenths of all our electric plants—are in a somewhat different position; in fact, many of them are paying a very small return for the money invested. The problem for many of them is: What can I do to make ends meet? In many cases this is not surprising to the engineer. The plant, perhaps, consists of one, two, or more engines, bought more with a view to saving first cost than anything else. The boilers are also the same—perhaps overrated as to capacity; the setting of each is poor, and their relative positions are bad; chimney drafts not good; boiler tops and domes uncovered; steam pipes bare, feed water pipes bare, and a few small leaks here and there of steam and water—the whole topped off with an engineer (?) at the munificent salary of $1.00 to $1.25 per day of 12 or 13 hours. No part of this plant is clean, and, in engineering, cleanliness is next to godliness; the man has neither time nor inclination for such work. The boilers are dirty, too, for want of cleaning out and the proper appliances to do it with.

If boilers are kept clean and well fired, the saving in coal amply pays for the cost, leaving a good margin of profit for the proprietor. A small leak through the exhaust valve of the engine soon makes itself apparent in the coal pile. Badly set engine valves are often prolific sources of loss; I have corrected engine valves and made a saving in coal of 12 per cent.

To the owners of smaller plants I would say, make the best of what you have got; stop all the small leaks and losses; get more of the heat in the coal into the engine, and keep the engine right. If you are burning 1,000 tons of coal per year you can save at least 25 per cent, or 250 tons, by keeping everything right; 250 tons of coal means in many places $1,000. This in many places can be saved by expending 40 or 50 per cent of it the first year—after that it should all be saved. Get a thoroughly well posted engineer to look over your plant and to advise you as to where savings can be made; don't go to a civil engineer or to an electrical engineer, consult a mechanical engineer. If you had a bad fever you would not go to a dentist for treatment. Go to the right kind of an engineer, pay him for his advice and follow it, and make an ordinary electric plant a reasonably good paying investment.

"DAY LOADS FOR CENTRAL STATIONS, AND HOW TO INCREASE THEM," BY J. A. KAMMERER.

At no period since the inception of the electric lighting industry have central station managers and operators taken such a deep interest in all the details of their plants.

As an evidence of this, there is no more encouraging sign than the constant desire by operators for the most complete information concerning, and a fuller understanding of, the apparatus they are using.

The result is making itself felt by those pioneers in electric lighting work, who are now profiting by their experience and reaping the first benefits of the departure from old lines of conducting electric lighting business. They are re-arranging their plants, or are completely constructing the same, with more efficient apparatus. One of the first questions asked by a pioneer central station manager, when he desires to purchase a new piece of apparatus is, "what is its efficiency?" not "what is the price?" His whole work must be to make the plant more efficient, and less expensive to operate and repair, and hence more remunerative in order to pay a dividend on the invested capital.

Other means of procuring remunerative return for energy expended and capital invested must be and is being sought. Additional revenue must be obtained from increased and prolonged use of current, to obtain which, means of having current used for other purposes than illumination must be found and consequently used in the day-time, or a "day load," as it is called, must be secured.

The aim, then, must be to place electric lighting central station business on the same footing as any other industry, by making the plant investment work a greater number of earning hours in each 24. To accomplish this there must be, in addition to its regular work, a day load for the lighting plant.

The multiphase alternating-current system, by which motor power can be provided, as well as arc and incandescent lights, meets the situation in this respect.

With existing single-phase alternating-current lighting plants, the change can be made without any considerable expense other than in the generator, as everything is already in place for the lighting, and the only expense for motor service is a small increase from time to time on capital account, as demand is made for power.

The cost of supplying a day load, in comparison with a night load only, is very much less, as the fuel necessary to start up the cooled boiler, and that for maintaining banked fires during the day would be saved. The depreciation on apparatus would be slightly greater, but the interest on everything and the depreciation on lines, poles, etc., are the same as if it were only an all-night run, thus making the additional expenses for the day run much less than the night run alone.

The central station operator is then in a position to give lighting service all day long, and add to his lighting business those consumers who have been heretofore objecting to using incandescent light, because of the necessity of maintaining coal oil or gas lamp lighting in dark places in stores, cellars, etc., during the day.

Where there is an electric light day service such consumers can not offer the excuse now made that risk from fire is as great with a few gas jets or coal oil lamps, as though they were to light throughout with an open flame light, and that the matter of the small additional cost of incandescent light is not their reason for not using it. As the central station can remuneratively furnish incandescent light throughout the 24 hours, this objection is removed, and a large amount of profitable business, which before could not be handled, can now be secured.

In dry goods stores where delicate fabrics are being handled, and where an open flame light creates risk from fire, the objection that different delicate colors can not be distinguished by artificial light is removed, as an arc lamp can be placed in these stores operating from the alternating-current system, which gives a near approach to solar light, and makes it an object for the storekeeper to install this light, as by it delicate colors are easily distinguishable.

While the additional revenue secured from these lights may not be sufficient to pay the extra expense of running a day service, yet it must be borne in mind that it is not alone the day load the central station is getting, but also an additional night load consequent on customers being provided with light for the full 24 hours.

This must be taken into consideration as making the night load more remunerative at a very small added cost.

These briefly are the points from a lighting standpoint that will commend themselves, and, no doubt, are familiar to most of the central station operators.

Aside from all this is the strictly speaking day load, which consists of the motor load, and which it is possible to secure with the multiphase alternating-current system. As a rule there is the butcher with his meat-chopping machine, the baker with his dough-mixer, the newspaper with its printing press, the foundry with its line of shafting to drive, and the planing mill with its machinery to be kept going throughout the day, in every town, while other and larger industries will be attracted to a town in which a day power service may be obtained. These different industries, all using power during the day-time tend to create a steady load line, which is especially desirable, as it increases the number of hours in which the investment is exercising its earning power, and helping to increase and secure the maximum load line throughout the 24 hours.

ADVANCE INFORMATION

New Incorporations.

BALTIMORE, MD. — The Virginia Electric Company, with a capital stock of $10,000, has been incorporated. Messrs. James Sloan, Jr., James Bond, E. J. D. Cross, William H. Ijams and William A. Molinard, incorporators. The business of the company will be generating electricity by water-power in Virginia and supplying it in places outside of Baltimore city.

CHICAGO, ILL.—The C. L. Pullman Car Company has been incorporated, to manufacture and sell street cars, by Charles L. Pullman, E. C. Pullman, G. E. Highley, H. J. Furber and George S. Steere. The capital stock is $5,000,000.

New Telephone Companies.

MOBILE, ALA. — The Interstate Telephone Company has been organized to operate a line between Whistler, Ala., and Waynesboro, Miss. The purpose is to connect this with other lines already organized. The following well known gentlemen were elected officers of the company: President, J. P. Wetherbee, of Waynesboro, Miss.; Dr. J. G. Michael, of Citronelle, secretary, and Peter Peterson, of Whistler, Ala., treasurer.

NORFOLK, VA. — The Southern States Telephone Company has a large force of men at work extending their lines to connect with the Nansemond Telephone Company, of Suffolk. It will be completed within 10 days.

HITCHCOCK, S. D.—A telephone line will soon be in operation between Redfield and Huron, by way of Hitchcock. J. S. W. Zeitelow, of Aberdeen and J. L. Hopkins, of Redfield, are interested.

WEYAUWEGA, WIS.—The Little Wolf River Telephone Company has been incorporated. The company includes in its territory Waupaca, Winnebago, Waushara, Portage, Outagamie, Marathon, Shawano, Landlade and Brown Counties. Capital stock, $6,000.

ANDERSONVILLE, TENN. — The Clinton Telephone Company has completed its line to this place.

DES MOINES, IOWA—It is understood the Iowa Telephone Company will erect a building in this city.

SHEPARDSVILLE, KY.—The telephone line from this place to Elizabethtown via Lebanon Junction is an assured fact.

FESTUS, W. VA.—The Fairmont & Western Telephone Company has been incorporated by J. F. Martin, S. J. Sturm, R. B. Parrish and others, for constructing and operating a telephone line to Fairmont.

TARBORO, N. C.—The Tarboro Telephone and Telegraph Company has been incorporated by George H. Holderness, James G. Mehegan, W. Newton Smith, Job Cobb, J. W. B. Battle, A. M. Fairley, and W. H. Powell, Jr.

MERIDIAN, MISS.—The East Mis-

sissippi Telephone Company has been incorporated by J. E. Evans, Wm. Henry, V. L. Terrell, and others, to construct telephone lines, etc. Capital stock, $50,000.

ROANOKE, VA. — The Interstate Telephone and Telegraph Company have completed a new telephone line from Roanoke to Fincastle, a distance of 15 miles, and it will be in operation in a few days.

Electric Light and Power.

ST. PAUL, MINN.—Oliver J. Tong, secretary board of control, City and County Hospital, may be addressed concerning establishment of an electric light plant.

OACALA, FLA.—City Clerk may give information concerning establishment of electric light plant. The General Electric Light Company have indicated their willingness to accept the offer of the city council of 22½ cents each for 36 arc lights, on a two years' contract.

HIGH FALLS, GA. — An electric lighting plant will be established, which will furnish electric light for Griffin.

MARTIN, TENN.—J. E. Kennedy, Mayor, may be addressed concerning electric light plant.

HOLDEN, MO.—City Clerk may be addressed concerning construction of new electric light plant.

CARBERRY, MAN.—The Carberry electric light plant destroyed by fire. No insurance.

STILLWATER, MINN.—F. W. Epley, of New Richmond, Wis., has applied for an electric power franchise. He promises to utilize the water-power of Apple River Falls for electricity and convey it to this city.

FORTUNA, CAL.—Swortzel & Williams electric light plant destroyed by fire.

SANBORN, IOWA—City Clerk may be addressed concerning electric light plant.

COLUMBIA, S. C.—A $6,000 electric plant at the lunatic asylum was destroyed by fire, also the building.

ADEL, IOWA—John A. Bramhall, of Des Moines, is interested in the establishment of an electric light plant in this city.

BRECKENRIDGE, MINN. — City Clerk may be addressed concerning electric light plant.

MAZEPPA, MINN.—City Clerk may be addressed concerning establishment of an electric light plant.

OZARK, ALA.—I. E. Edwards, city engineer, may be addressed concerning electric light plant.

BEDFORD, OHIO — The People's Electric Light Company has been incorporated with a capital stock of $1,000.

New Electric Railways.

KANSAS CITY, KAS.—The work of repairing the west side electric line in this city has been begun by the Metropolitan Street Railway Company. The work will continue until the road is put in a first-class condition.

PITTSFIELD, MASS. — The street railroad company have decided to buy a plant for furnishing power for their road and will place it in the electric company's station, and not build a power-house of their own, as first talked. The electric company will build an addition to accommodate the machinery and will furnish boiler capacity.

ANDERSON, N. Y.—The contract for building an electric railroad from this place to Marion, a distance of 31 miles, has been let, and a large force of men are at work.

Business Troubles.

ST. PAUL, MINN.—Standard Brass and Electric Company reported to have made an assignment.

NEW YORK, N. Y.—Arthur Ingraham has been appointed permanent receiver of the Electric Railway Company of the United States, 17 Broadway. The liabilities are $28,250 and assets $5,041.

Roller Bearings for Traction Cars.

Recent experiments on roller bearings under traction cars in England go to show the remarkable reduction in starting effort of from 50 to 83 per cent, and an average showing was made as follows: Relative starting effort of a car on a gradient of 1 in 20 — ordinary bearings, 100; roller-bearings, 77; saving, 23 per cent. On a gradient of 1 in 80—ordinary bearings, 100; roller bearings, 50; saving, 50 per cent. On a gradient of 1 in 140—ordinary bearings, 100; roller bearings, 39.6; saving, 60.4 per cent—results which require no comment.

The Louisville & Nashville Railroad Company has just completed, at Montgomery, Ala., a handsome new freight station, 545 by 50 feet, of brick with slate roof, and two stories high. Three electric elevators are provided for transferring freight between the floors, and the building is lighted throughout by electricity.

Another use now developed for the electric motor, and successfully, is for driving the apparatus for charging the materials into open-hearth steel furnaces. One motor operates the "charging bar," and another drives the charger truck or car.

The Berlin Iron Bridge Company, of East Berlin, Ct., are erecting a new roof for the power station of the Scranton Illuminating, Heat and Power Company, of Scranton, Pa. The building is 42 feet wide and 195 feet long, divided into two portions—a boiler room and an engine room. The framework of the roof construction is of steel and absolutely fireproof. It has been the aim of the Scranton company to erect a substantial and fire-proof building to replace the one which they recently lost by fire.

KIND WORDS.

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TO THE EDITOR OF ELECTRICAL REVIEW:

I wish to say that the ELECTRICAL REVIEW is the peer of all electrical journals, and I can not afford to be without it, at any price, in order to keep posted in the advance of electrical science. JAMES C. KOEHL.

June 9.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JUNE 8, 1897.

583,900 Electric meter; Jesse Harris, Lynn, Mass.—Consists of a system of coils arranged at an angle to each other and being free to move, said movement being limited by a resilient device, and having a movable contact arranged to be operated by the fan-like device that the circuit may be automatically opened and closed.

583,903 Feed wire connection; S. H. Harrington, New York, N. Y.—A connector for underground trolleys and the like, consisting of a plug or ferrule adapted to be secured in a rail, and a plurality of flattened wires adapted to engage with a feed wire or cable.

583,912 Secondary or storage battery; A. S. Krotz, Springfield, Ohio.

583,916 Search-light mount; F. T. Marchand, Annapolis, Md.—Consists of a column revoluble about its vertical axis, a stationary base supporting said column, a platform surmounting said column and capable of angular displacement around a horizontal axis, means for displacing said platform around said axis, and a gyroscope controlling said means.

583,933 Electric motor; E. S. Pillsbury, St. Louis, Mo.—Consists of the field magnets of a progressively wound armature, a commutator therefor, a closed winding on the armature, means for short circuiting the progressive windings of the commutator, and a switch in the motor circuit which is operated by said means.

583,934 Shunt-ammeter; W. B. Potter, Schenectady, N. Y.—A plurality of ammeters connected in shunt to a common resistance.

583,935 Series parallel controller; W. B. Potter, Schenectady, N. Y.—Consists of a cylindrical switch, contacts thereon, and sets of stationary brushes engaging therewith, the brushes and contacts bearing such a relation to each other that the circuit is alternately completed or broken at one set, then at another.

583,936 Electric furnace; E. F. Price, Niagara Falls, N. Y.—A hearth having a slab of carbon and forming one electrode inclosing walls, a wall and roller for supporting one end of the hearth, and an adjusting screw for regulating the inclination of the hearth, and carbons adjacent to the hearth forming the other electrode.

583,938 Pneumatic controller; E. F. Priest, Schenectady, N. Y.—A plurality of separate pneumatically operated contacts for varying the resistance of the motor circuits.

583,939 Pneumatically actuated controller; E. D. Priest, Schenectady, N. Y.

583,944 Rotary converter; E. W. Rice, Jr., Schenectady, N. Y.

583,945 Electric light for vehicles; A. M. Rodriguez, Brooklyn, N. Y.—A wheeled vehicle, having an electric lamp and generator mounted thereon, a friction wheel rotatively mounted on the vehicle and in peripheral contact with some part of the wheel thereof, and a flexible shaft between the shaft of the wheel and the arbor of the armature of the generator and connecting the same, whereby the former drives the latter.

583,950 Three-phase induction meter; C. P. Steinmetz, Schenectady, N. Y.

583,951 Motor meter; C. P. Steinmetz, Schenectady, N. Y.—An inductive device for obtaining a definite phase displacement between a circuit and a branch thereof, consisting of two windings having different numbers of turns inductively related upon a common core, said windings being included respectively in branches of the circuit.

583,953 Apparatus for producing currents of high frequency; Nikola Tesla, New York, N. Y.

583,955 Carbon holder for arc lamps; E. Thomson, Swampscott, Mass.

583,956 Producing stereoscopic pictures by Roentgen rays; E. Thomson, Swampscott, Mass.—Consists in exposing the object to be photographed to a source of Roentgen rays in one position, and then shifting the relative positions of the source of rays and the object while making a second exposure.

583,959 Safety lamp; W. Waegel, Philadelphia, Pa.

583,963 Electric switch; G. Winckler, Schenectady, N. Y.—A base, terminals mounted on the base, a blade for closing the circuit between the terminals, a back or lever to which the blade is removably secured, and a handle for securing the blade to the back and operating the switch.

583,987 Lightning arrester; A. Ekstrom; Schenectady, N. Y.—Comprises a number of spark-gaps in series, of a kind to have their resistance decreased by use, combined with means controlled by such decrease in resistance, for increasing the number of spark-gaps in series.

583,991 Binding band for armatures; H. Geisenhoner, Schenectady, N. Y.

583,997 Turn-table for surface-contact electric railways; E. M. Hewlett, Schenectady, N. Y.

584,029 System of electrical distribution; J. Woodbridge, Brooklyn, N. Y.

584,050 Process of and apparatus for aging alcoholic liquors; H. Deininger, Berlin, Germany.

584,056 Igniting device; B. Jolles, Vienna, Austria.

584,128 Synchronizing clock; J. H. Gerry, Brooklyn, N. Y.

584,149 Automatic electric time switch; L. H. Watters, Media, Pa.

584,173 Hotel electric call apparatus; A. B. Chance, Centralia, Mo.

584,184, 584,186 Electric arc lamp; G. L. Moyer, Hartford, Ct.

584,185 Cut-out switch; G. L. Moyer, Hartford, Ct.

584,202 Burglar alarm system; W. T. Arnold, Chicago, Ill.

584,235 Insulator for telegraph or other electric wires; C. C. Nesmith, Manchester, Ala.

584,258 Prepayment mechanism for electrical or other meters; C. O. Bastian, London, England.

584,297 Non-interfering signal box; J. T. Stack, Chicago, Ill.

584,299 Connection for electrical conductors; B. F. Weldon, Pittsburgh, Pa.—A connection for electrical conductors or wires comprising an inclosing envelop surrounding the wires and bent transversely.

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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

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Kindred.... ...Interests

The Stiles & Fladd Press Company, of Watertown, N. Y., have issued a new catalogue, which represents one year's business. Their first machine was shipped about May 1, 1896.

It is quite rare that wholesale houses located at inland points enjoy much foreign trade, but a notable exception can be found in the Central Electric Company, of Chicago, who state that for some time they have had quite a large trade with points in Japan, as well as South America, and quite recently they received a very large order from South Africa, which was secured by submitting quotations in competition with other firms.

The Electric Appliance Company, Chicago, have been so very successful in the introduction of the American electric soldering iron that they are preparing a circular of a few of the many testimonial letters received from customers in regard to the operations of these irons. Many customers have written them that, although they had tried each and every soldering iron placed on the market, the American iron is the first one that is a commercial success. The Electric Appliance Company look for a very large sale of these goods, as a satisfactory electric soldering iron has long been wanted.

The Highland Electric Soldering Paste is meeting with very great favor as a soldering flux, which seems to possess every advantage, and none of the disadvantages of the other kinds on the market. It is put up in very convenient form for use, and certainly makes a very successful joint. The Electric Appliance Company, of Chicago, who handle this soldering paste in the West, are sending out small sample boxes, and state that the samples they have distributed have already resulted in the sale of several hundred pounds of the soldering paste, and that every customer is highly pleased with the work they can do with this flux.

The Chas. E. Gregory Company, Chicago, reports a more gratifying condition of business than has been experienced for some time. This, Manager Kuehmsted explains, is possibly due to the fact that electric light and power men are gradually beginning to realize that a so-called "second-hand" machine is often fully as good or even better than a great many new ones, provided it has been thoroughly overhauled and its weak points remedied by competent hands. In the way of doing expert repair work the company has exceptional facilities, and having had opportunities to thoroughly examine and repair nearly every known type of electrical apparatus during the past several years, it is but reasonable to suppose that during that time it had ample opportunity to study the causes of faults in machines and avoid them in the reconstructed apparatus.

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This will be welcome news to the general public and to B. & O. enthusiasts—people who would not take any other route to their destinations if the B. & O. would possibly serve them. These are mostly passionate admirers of natural scenery, to whom the gigantic panorama along the B. & O. route can never become stale. Indeed, why should it, when it is never twice the same? Scenery on a scale of such immensity is like the ocean in its susceptibility to change. Not only with the seasons, but with the days, does its beauty vary. And even through a Summer day it is never the same scene an hour at a time. Like a kaleidoscope, which the slightest alteration in position occasions a totally new view, so the forests and the mountains along this scenic route assume wholly new appearances with every passing cloud and every weather condition.

Now that the exaggerated bugbear of the B. & O. curves has been finally disposed of, and its roadbed made second to none, the excellence of its equipment and the peculiarly "make-yourself-comfortable-we'll-do-everything-we-can-for-you" atmosphere which surrounds the traveler the instant he steps aboard a through train on this road will shortly double and treble the number of B. & O. enthusiasts, to whom the journey over mountains is less a journey than a pleasure. — *The Pittsburgh Star*, June 5, 1897.

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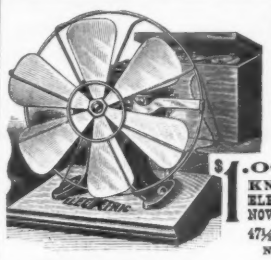

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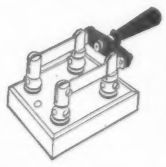

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1	55 "	Edison.	2	350 "	Mather.
2	60 "	Westinghouse.	2	350 "	Edison.
1	60 "	Richter.	1	360 "	Westinghouse.
1	75 "	Eddy.	1	420 "	United States.
1	80 "	Westinghouse.	1	450 "	Edison.
1	100 "	Triumph.	1	500 "	Brush.
2	110 "	Edison.	1	650 "	Westinghouse.
2	150 "	"	1	750 "	Edison.
1	170 "	Royal.	1	1,000 "	"
1	200 "	Westinghouse.	1	1,000 "	Standard M. P.
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